AGRICULTURAL ENGINEERING

The Journal of the American Society of Agricultural Engineers

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ASAE

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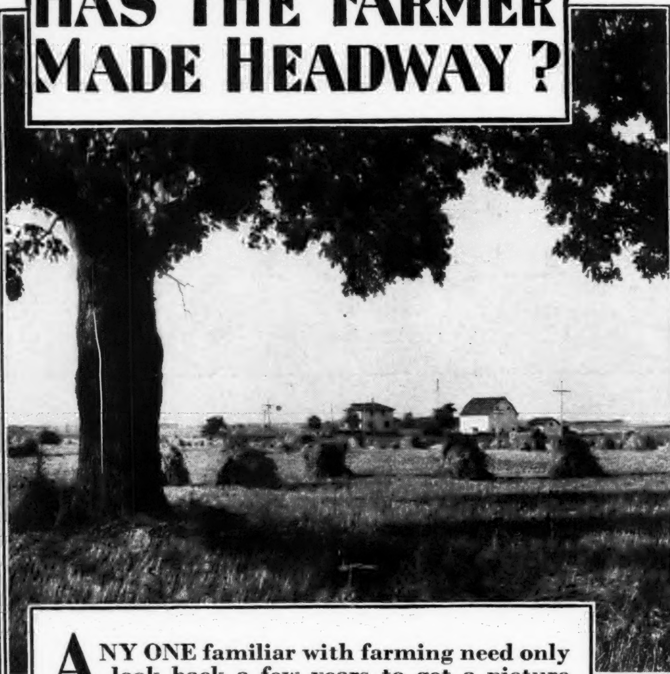

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AGRICULTURAL ENGINEERING

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Recent Experiments in Drying Seed Cotton

By Charles A. Bennett[1][2]

"SEED-COTTON" is the harvested, raw cotton as it comes from the field. It is made up of locks of cotton fiber or cotton lint in which are embedded the cotton seeds. These locks usually contain foreign matter which results from wind, weather and harvesting. Hand-picked cotton, of course, is cleanest and usually contains only a few leaves, hulls, etc.; mechanically picked cotton is liable to contain a heavy portion of leaves, stems, and hulls; while sledded cotton is probably the dirtiest seed-cotton that is handled, and it may contain sand, hulls, leaves, sticks and about every conceivable form of trash.

Near the beginning of the twentieth century, a strong tendency to improve all the methods of handling cotton was manifested, although the invention of the cotton gin by Eli Whitney had been accomplished many years before. Hand gins went out of use and machine gins were introduced; tramping the cotton into presses by bare feet was superseded by the superior mechanical trampers; hydraulic and power presses replaced the hand press; and the planters became interested in the breeding of seed and improved methods of growing and harvesting cotton.

The time was when the cotton plant yielded its seed-cotton in cycles. The first pickings of the season were found near the bottom of the plant; then the middle of the plant was picked on the next round, and finally topped off the cotton near the close of the season. All of these pickings went in sacks or baskets to large plantation cotton houses for storage, and where any damp cotton was found it was placed upon broad platforms, exposed to sunshine, and turned over until dry. After all the crop had been gathered, the plantation ginning began in a leisurely fashion.

Now, however, changes are evident at every turn. The planter buys his seed from certified sources, and a crop matures simultaneously all over the plant. Often with severe shortages of labor and under unfavorable weather conditions, the planter endeavors to harvest his crop almost before it comes into sight; the wagons rush to the cotton gins; the bales roll out upon the platforms; and the ginners and cotton buyers begin to have their troubles. Where formerly the old steam-driven gins told the countryside by their tall stacks that ginning had commenced, we now find the Diesel-engine powered outfits or electrically operated equipment. Heavy investments have been made in cleaning and ginning to improve the sample, and no time is lost in trying to turn the crop into cash.

Demands for rapid harvesting methods have led to the development of improved types of cotton cleaners so that almost a hand-picked sample of clean seed-cotton may be delivered to the gin stands without the heavy harvesting costs entailed by hand picking. This in turn has led to a pressing need for driers in certain seasons of bad weather or early harvest.

[1]Paper presented at the Power and Machinery Session of the 23rd annual meeting of the American Society of Agricultural Engineers at Dallas, Texas, June, 1929.

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The earliest pickings of seed-cotton now rushed to the gins are frequently very green and sappy. The seed-cotton has been picked in the fields under conditions of high humidity and morning dews, and this early green cotton has not cured. Its fiber feels sticky to the touch, its seeds mash readily to a pulp, and it wads up and gums up when put through the cotton gin saws. For this reason the samples are often badly napped, twisted and mutilated, causing loss of time in ginning, and inevitably resulting in depression in market price for seed and fiber.

A rapid drying of this early green cotton when it comes to the gin in such a shape is an excellent preparation for smooth ginning and results in benefits to all concerned. For instance, two bales of this kind of cotton from the same field were carried through a gin. The first bale was dried in about 30 minutes at a cost of not over a dollar; the second bale was ginned without drying, but was rolled out onto the platform and shipped in the same lot to Vicksburg, Mississippi. The owner of the bales received word that the first (dried) bale was accepted at top market price and immediately sold, but the second bale was rejected and, after considerable parleying, was sold for 3 cents per pound under the market. Since the bale weighed over 500 pounds, the owner gained a gross profit of about $14 on the dried bale.

Our experiments thus far have not clearly proved whether or not this rapid drying upon the early cotton produces an equivalent to natural sun curing, but the sticky characteristics are removed beyond doubt, and the gins make a good sample without slowing up their speed. Where the cotton can be exposed to the sunshine in a natural-curing process, it is probable that a chemical change takes place which includes drying but is not the same as a mere removal of moisture. In other words, curing may include drying, but drying may not include curing in the real sense of that term.

Before undertaking experiments upon drying seed-cotton, a series of studies were made to determine the general characteristics of cotton and the customary rates of handling cotton at most public gins. Good samples of seed-cotton weighed from 4 to 5 pounds per cubic foot when loosely packed, and the moisture content varied from 20 down to 10 pounds of moisture per 100 pounds of seed-cotton as the season advanced.

When the seed-cotton contained less than 15 pounds of moisture per 100 pounds, the gins could usually make a good sample; and as this indicated an excess of from 1 to 5 pounds of moisture per hundred weight, an average of 2.5 per cent moisture removal seemed reasonable. Experiments in the drying of the cotton later substantiated this fairly well.

At the government field laboratory located at Tallulah, Louisiana, and generally known as "Delta Laboratory," the weather conditions are about average for the cotton-growing regions of the country. These conditions during the ginning season approximate a relative humidity of 75 per cent and an atmospheric temperature of from 70 to 80 degrees (Fahrenheit). The cotton gins to be found in the adjacent states usually handle about 100 pounds of seed-cotton per minute through their unloading spouts, the cotton being universally handled by pneumatic methods

and dropped where required by means of "separators" within the gin buildings.

Hygroscopic properties of seed-cotton are such that the fiber will adapt itself quickly to atmospheric conditions. Any drying must therefore be shortly followed by ginning if benefits are to be realized. Under the capacities stated for usual public gins, the designs for driers were worked out upon an assumed handling of 100 pounds of seed-cotton per minute.

In order to meet a large number of variables in weather and cotton conditions, it was considered advisable to adhere to the general methods of drying which employ currents of heated atmosphere; test models being first constructed for study, and these followed up by full-sized units when warranted by the first tests.

Fig. 1 shows a view of one of the first model driers which was constructed in the form of a simple gravity tower with inclines. This was devised to determine whether or not a drier without mechanical conveyor would be feasible for handling a continuous stream of cotton.

The triangular spaces beneath the inclines were heated, and the volume of heated atmosphere or drying medium passed upward through the zig-zag passage down which the stream of cotton was descending. The inclines were made adjustable for finding the approximate limiting angles of friction under different conditions of up-blast velocity. For velocities above 400 feet per minute, the inclines must be approximately 60 degrees, and with high velocities around 1000 feet per minute the fluffiness of the cotton prevents a uniform downward flow of the cotton.

The elapsed period of descent or exposure within such a tower proved to be such that an adequate assurance of good drying could hardly be secured unless the height of the tower was to be about 70 feet. Accordingly another model was constructed which utilized an intermittent handling of the cotton instead of a continuous flow.

The oldest and simplest forms of cotton handling equipment made use of a "dropper" which operated in combination with a mechanically-tripped valve on the fan suction. By this means a volume of cotton would accumulate in a bottomless box with a canvas leg, and when the fan suction was broken the mass of cotton would be liberated through the canvas leg. Fig. 2 illustrates a side view of the model drier which was arranged with a series of trays having screen bottoms. The trays were so pivoted and counterweighted as to dump to the next tray below in synchronism with the feeding mechanism of the "dropper." The heated air passed upward through the trays, while the seed-cotton passed downward from one tray to another by gravity at each period of tripping. This unit was interesting and gave very good results, but it was difficult to secure a uniform spread of cotton upon the screened trays.

The studies and results thus far had clearly indicated that a time of drying or period of exposure might be anywhere from 40 seconds to 3 minutes. Other government tests showed that hot-blast temperatures of from 160 to 175 degrees would not endanger the germinating qualities of the seed, if the exposure did not exceed 15 minutes. The volumes of heated air required varied from 40 to 100 cubic feet per pound of damp seed-cotton. Upon these fundamental features of drying. were based the design and erection of a full-sized drier at a cotton gin. This drier is outlined in diagram in Fig. 3 and operated during the 1927 season with good results. It was housed in a temporary shed having bins on the first floor and the drier cabinet and equipment on the second floor.

Fig. 4 gives a view of the cotton gin, cotton house and environs, with the drier building visible in the background at the right, behind the cotton house. The overhead pipe to the cotton house was extended to the cotton bins beneath the drier, so that dried bolls of cotton were transferred to the gin pneumatically.

This first full-sized drier had twenty-three trays enclosed in a wooden cabinet which was baffled in such a manner as to conduct the continuous current of hot air through the loaded trays. The trays were about 5 inches deep, 16 inches wide and 5 feet long, each tray being bolted with ¼-inch bolts to two endless detachable-link chains which rode upon 2x4 rails at the sides of the cabinet. Between the trays, cotton cloth hammocks or connections were attached to prevent loss of cotton or hot air between the trays. A top view of these trays, shown in Fig. 5, taken after removal of the drier top, shows the trays on their way toward the delivery end of the unit.

For driving the endless-conveyor mechanism of trays, a worm and wheel reduction was used. This was driven by an engine with three-speed governor, as shown in Fig. 6. The power of the engine was 1.5 hp., and the lineal speed of the conveyor was such as to give an exposure within the cabinet of from 40 to 60 seconds Equivalent exposure of a much longer period could, of course, be secured by feeding the cotton into the trays in a thinner layer.

Fig. 7 illustrates one of the steam-heating elements by means of which the hot-blast was kept at from 160 to 180 degrees during the drying runs. Six of these elements were constructed with 2x6 frames measuring 3 feet by 4 feet inside, each frame containing two complete coils. The net free area of this construction is 5.5 square feet; heating surface per frame is 17.4 square feet; and eight complete frames are advised as a result of many experiments. Eight complete frames give a heater sixteen rows of pipe in depth, and with such a heater the temperatures of the hot-blast may be adjusted up to about 220 degrees. After the frames are aligned in position, the installation is completed by sheathing the exterior with building paper and gypsum board to make an air-tight, insulated heater.

Steam pressures for the experimental driers varied from 60 to 100 pounds gage, the piping being so laid out that condensation returned to the boiler by gravity without the aid of pumps or traps. By this method of piping and heater installation, a variation in pressure does not seriously affect the drying. Make-up water is also minimized by saving the condensate from the coils, and unskilled labor can handle the boiler quite economically, particularly if the boiler is of the vertical type which is self-contained and easy to fire.

In order to use a farm tractor as the principal source of power, a single No. 35 gin fan was used to unload the cotton wagons and to supply the volume of air necessary for the drying. Such a combination is open to the objection that it cannot be employed where dirty cotton is encountered. Neither can a single fan be employed where it is desired to substitute a special drying hot-air furnace in place of a steam boiler installation.

Fig. 8 shows the side view of the drier building with the farm tractor belt drive. Shortly after the picture was taken, the building was made complete by erecting a shelter over the tractor and belt so that operation might continue in rainy weather.

From the many runs made with the first horizontal drier during the ginning season of 1927, many interesting observations were made. Those of particular interest in this discussion are concerned with costs of operation and results secured, together with improvements found to be advisable for incorporation in future driers of this kind.

The average bale of cotton lint runs around 500 pounds in weight, and is approximately one-third of the original weight of the seed-cotton brought into the gin. Costs of drying a load of seed-cotton to make an average bale of cotton lint was about as follows:

Cost of fuel (1 ton of $10 coal per 24 bales of cotton)	42 cents
Cost of gasoline and tractor oil (not to exceed)	25 cents
Cost of unskilled labor	25 cents
Total	92 cents

Improvements in the value of the cotton due to drying it before the ginning was quite variable, and ran from

½ cent per pound to as high as 3 cents per pound. This would bring a gross improvement of from \$2.50 to \$15.00 for a standard bale. The improvement was obvious in cases where the cotton could not possibly have been ginned without being dried first. From this gross increase in value some planters may insist upon deducting the water removed, which they value at the current price of the lint.

Very frequently cotton came into the drier in bad condition and went from the drier to the gins in such good shape that there was no difference noted by the buyers between the dried and the best of the undried cotton. On the other hand, many cases of rejection were noted on undried bales which should have been dried; and many bales of cotton lay unpurchased on the platforms in the season of 1928 because the samples were so poor that no buyer could afford to take them over.

Improvements suggested for this kind of a horizontal drier are that the number of trays should be increased to at least forty-two or more, and that the length of run

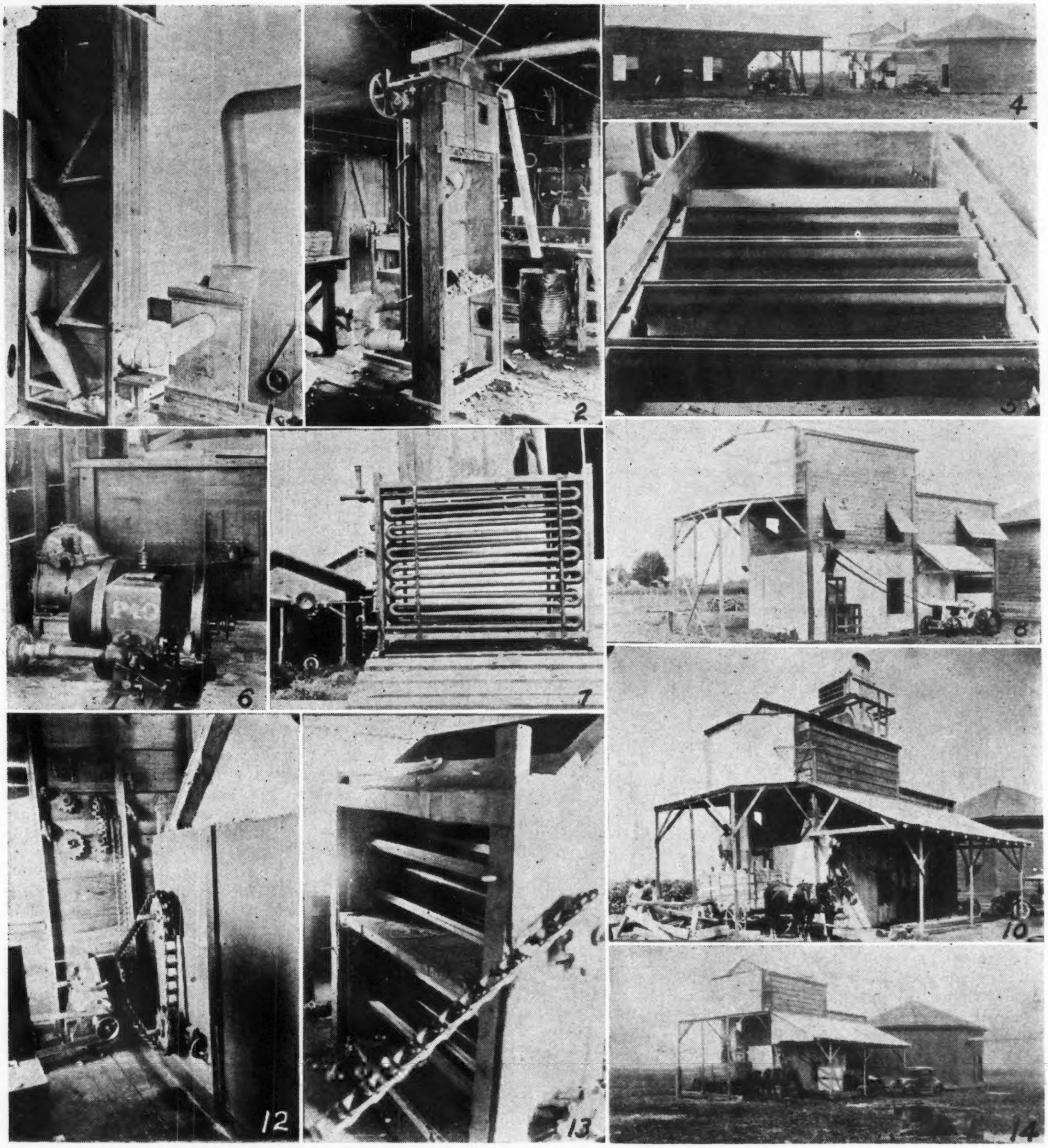
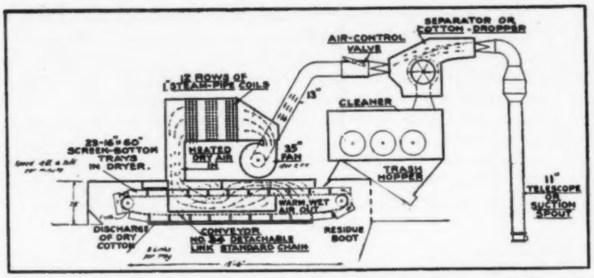
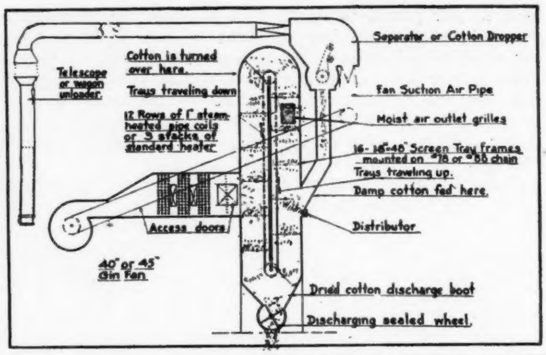
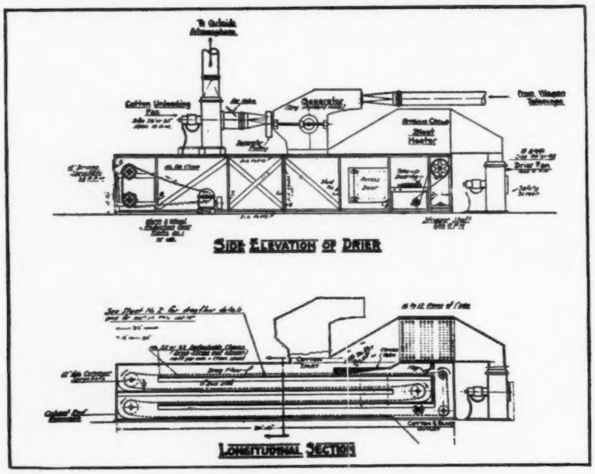


Fig. 1. One of the first model cotton driers built in the form of a gravity tower with inclines. Fig. 2. Side view of a model drier arranged with a series of trays having screen bottoms. Fig. 4. Buildings housing drier shown in Fig. 3 and other ginning equipment. Fig. 5. Top view of trays of drier shown in Fig. 3, with drier top removed. Fig. 6. View of engine and worm and wheel reduction for driving endless-conveyor mechanism of trays. Fig. 7. One of the steam-heating elements used in the government experimental drier. Fig. 8. Drier building showing tractor belted to gin fan to unload cotton wagons. Fig. 10. Drying plant with drier shown in Fig. 9 installed. Fig. 12. This shows how the worm and wheel is used to drive two shafts. Fig. 13. One end of the drier shown in Fig. 11 with end panel removed. Fig. 14. This view indicates weather conditions encountered with drying runs on drag-type drier







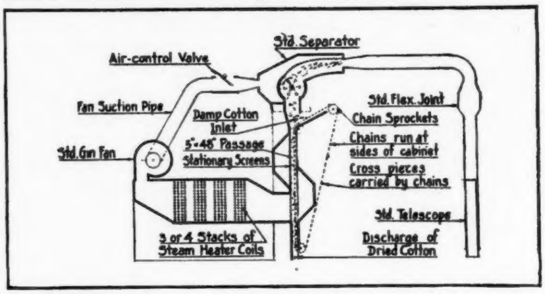


Fig. 3. (Upper left) Diagram of the first full-sized cotton drier (horizontal style). Fig. 9. (Upper right) Another type of drier (vertical style) erected in 1928. Fig. 11. (Lower left) Diagram of the third type (drag type) of cotton drier. Fig. 15. (Lower right) Diagram of drag-type drier applied to the vertical form of construction

should be accordingly increased. By making the baffle spaces of the drier roomy, and by lining them with sheet metal, the desired oven-effect may be advantageously employed along with the hot-blast.

Fig. 9 illustrates the diagram of another type of drier which was erected at the gin for the early season of 1928. This drier had sixteen trays and was 18 feet high between centers of shafts. It looked much easier to build than it actually was, and it presented many difficulties in broken trays and bent braces until the causes of wedging were discovered and remedied. Fig. 10 is a photograph of the drying plant with this drier installed. The dome of the drier may be seen projecting through the roof of the temporary drier building. Final conclusions reached after these runs were that the principles of the drier were all right as proved by the runs, but that the construction of such a type of drier should be done by regular manufacturers who were equipped to do this kind of work.

Following the experiments upon the vertical drier, the next construction employed was that shown by diagram in Fig. 11. This drier marked a decided departure from the principles employed in previous types. Here the flow of the drying medium was made concurrent with that of the cotton, and the discharges for both dried cotton and moisture-laden atmosphere were accomplished at the same place without any mechanical features except a stripper wheel which is later explained. In this kind of a drier, the conveying is done by dragging the cotton along smooth metal floors kept heated by the currents of hot air which are coming in contact with the seed-cotton also. The chains are plain detachable-link chains with ears or lugs at intervals of about a foot, and double strips of wood or metal are connected across the chains so as to make a drag conveyor through whose cross-members the cotton may readily fall when the drags reach the end of each run.

At the end of each drag-floor or run, the seed-cotton drops through the conveyor and is again picked up on the floor below. The inlets of the cabinet are protected from loss of hot air by the simple canvas flap which lies upon the upper drag floor in such a manner as to permit the conveyor to pass beneath it. The constant turning effect of the cotton, its redisposition upon the drag floors and its travel along heated sheet metal surfaces gives a very good drying results.

In order to prevent undue friction and to guard against machining the cotton, the conveyor strips were caused to ride upon flat metal rails placed near the sides of the cabinet. After this was done, the speed of the conveyor was tested to as much as 125 feet per minute without difficulties of any kind. At these speeds it was not hard to dry a bale of cotton in 13 minutes.

If there is plenty of space available in which the drier may be installed, the design of the drier may be made into only two drag-floors, and the conveying simplified by the use of only two shafts. In case several shafts are used, and a multi-pass construction employed as shown in Fig. 11, the best method of driving the conveyor is to use more than one shaft to transmit the power through. This is shown in the view of Fig. 12, in which a worm and wheel drove two shafts of the drier. Such a method of driving equalized the strain upon the several runs of chain and made the power consumption lower.

Fig. 13 shows one end of this kind of a drier, with the end panel removed for access to the drag flooors and conveyor. The simplicity of this drier is evident from the illustrations, but there is one feature usually needed to make the drier discharge its cotton readily. This is the stripper wheel which was previously alluded to. It must run so that its tips wipe off the cotton in a direction opposite to the movement of the conveyor.

Fig. 14 gives a good idea of weather conditions encountered during many of the drying runs with the drag-type of drier. Rain, mist, soaked cotton and miserable weather were frequent, and yet good drying results were secured in most of the runs. A few runs had to be done over because the cotton was so wet and packed that the conditions to be overcome were very severe.

Fig. 15 illustrates by diagram the drag-type of drier applied to a vertical form of construction with some modifications. This kind of a drier is primarily a chute having two broad sides of wire mesh and two narrow ends of wood or metal. The seed-cotton is conveyed downward through the chute, across which the currents of heated air zig-zag back and forth. The cross-strips on the chains do not allow the cotton either to fall or to choke in the chute.

At the bottom of the chute, the cotton passes through a leg or extension of air-tight construction on all sides, so that it forms a bottom seal which offers more resistance to the hot-blast than do the regular channels.

Although not shown on the diagram, this kind of a drier must have well-fitting chain guides at the outer edges of the chains, so that there may be no swaying or buckling of the chains as they pass down the chute. The spacing of the cross-members should be about 9 inches or less apart; the more the number of strips, the better the action of the drier.

The general dimensions of this chute vary from 4 to 6 feet in length and from 4 to 6 inches in width at the throat (chain passage). Five inches gave excellent results and 6 inches becomes a sort of limit because beyond that width the cotton tends to roll up in such a manner as to wedge the conveyors. The height of the chute should be 20 feet or more.

The various types of driers described in this discussion together with the process of drying are patented by the government and are therefore open for free use by any person in the United Sataes. The process may be used with new methods of handling, or the methods of handling may be used with different volumes and temperatures than those included in the government process; but it is hoped that this series of experiments will lead to the adoption of driers in many places. The cost of a good drier will run from a thousand dollars up, but there are many gins which have second-hand equipment in their store-rooms that may be used to build a good drier very cheaply.

With all the demand for dry cotton which comes from ginners and users, the time must come when no gin will be considered complete without a drier, just as it is now not considered to be up-to-date unless it has good cleaners.

Ease and Comfort in Tractor Operation

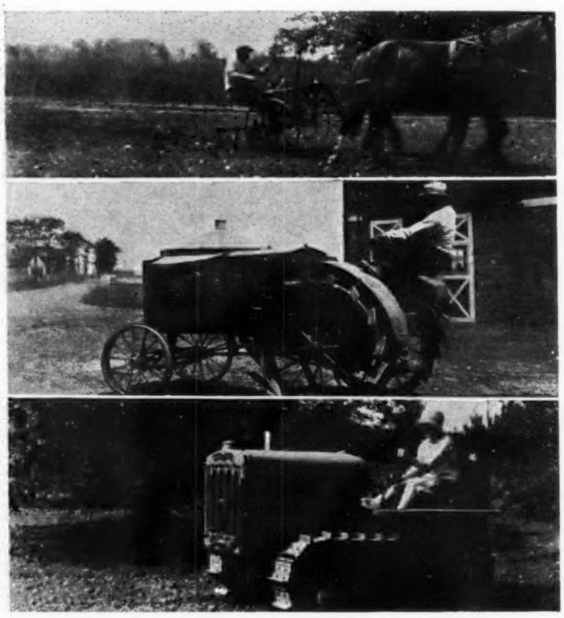
By D. B. Lucas[1]

IN A recent article in AGRICULTURAL ENGINEERING[2] D. C. Heitshu said: "The large majority of present-day tractors are safe for the operator, but not comfortable. A truck driver is given all the comforts of a coupe to insure his continued efficiency; yet the tractor manufacturers offer the farmer a tractor with a pressed steel seat that possesses neither back nor springs."

Tradition among farmers may have been largely responsible for the persisting hard and solid tractor seats. Just recently a staunch, middle-aged New England gentleman proudly boasted that he could remember when he walked for ten or more hours every day through the spring and summer, beginning with the plow and continuing on through the cultivating season. Many farmers still walk strenuously behind implements which could be handled as well from a seat. There is much resistance among older farmers and older farming sections to the adoption of the practice of riding on field machines. The idea seems to have been handed down that there is virtue in trudging wearily along behind the plow, although the gentleman just quoted admitted his fatigue and discomfort, and described the effort required in doing the evening chores. This tradition must be broken down before open-mindedness and unhampered progress can prevail in agriculture.

[1]Assistant professor of agricultural engineering, Rutgers University. Assoc. Mem. A.S.A.E.

[2]Vol. 10, No. 5.



(Top) Slow, but not very strenuous, field work with a self-guiding power unit
(Middle) This old tractor has done many a good day's work, but so has the man who ran it
(Bottom) Genuine comfort and a minimum of effort to operate can be attained through proper design of seat and steering mechanism

One of the biggest problems confronting the tractor industry lies in making tractor farming more pleasant than the use of animal power. Both ease and comfort of operation are involved in the solution. There is nothing much easier than driving a team of horses down a corn row. The lines are hung up on a convenient lever and the horses will keep to the row with little guidance. The prospects of making a tractor which will be self-guiding in corn rows are none too promising, but there has been great improvement in the steering mechanisms of tractors. The illustrations make a good comparison between the discomfort and effort involved in operating one of the older tractors and the luxury and easy control of a more recent machine. Unfortunately the solid pressed-steel seat is still used on most present tractor models. Manufacturers can afford to spend more money to improve the seats on tractors than on horse-drawn equipment. Only one seat is required for the tractor, whereas individual seats have to be provided for most implements drawn by horses. It is probable that the horse always will be easier to guide in row cultivation, but the tractor assumes the advantage in many other operations and especially where large units of power are required. Whether as a means of offsetting the advantages of animal power, or as a step in needed progress, sentiment should turn increasingly toward sparing the farmers' daily effort so as to provide surplus energy to be applied in increased efficiency, outside activities and happiness in his vocation.

A Study of Dairy Coolers in California[1]

By J. R. Tavernetti[2]

THE California Committee on the Relation of Electricity to Agriculture is making a study of dairy refrigeration in California consisting of three parts:

1. A survey of dairy refrigeration plants on farms in various parts of the state
2. Determination of the power consumption of various plants over a period of one year
3. Determination of operating characteristics of representative plants.

The Survey. The survey, which has been completed, was conducted in March, May, June and July of 1928, in the vicinities surrounding Davis, Sacramento, Stockton, Tracy, Modesto, Turlock, Fresno, Ontario and Chino. Seventy-three dairies were visited and data obtained both by questioning the dairymen and by personal observations and measurements. Some of the data and conclusions drawn from this survey follow:

1. On the 73 dairies visited there were sixteen different makes of refrigeration machines.

2. Of the seventy-three machines, twenty-nine used sulphur dioxide as a refrigerant, thirty-eight used ammonia and six used methyl chloride.

3. Fifty-three of the dairies had storage boxes made on the farm; eight had factory made storage boxes; and twelve had no storage boxes. This shows that there is a tendency for the farmer to build his own storage box. Most of these boxes are the walk in type, designed with enough floor space to handle the number of cans desired. In the vicinities of Chino and Ontario where the milk is delivered twice a day, many of the dairymen had no storage boxes; others had storage space for from two to six cans.

4. Twenty-eight of the plants used sheet cork for insulation, nineteen used granulated cork, nine used sawdust and six used rice hulls.

5. The thickness of insulation varied from 3 to 4 inches for sheet cork, 4 to 6 inches for granulated cork and rice hulls, and 4 to 10 inches for sawdust. The objection to cork insulation is the initial cost. Sawdust and rice hulls have proved satisfactory if sufficiently thick and kept dry.

6. The general practice has been to place the brine tank inside the storage box, either on the floor or suspended from the ceiling. When suspended from the ceiling it is held high enough to allow cans to be placed underneath it, thus reducing the size of the storage box. Many of the large installations and those not having storage space had the brine tank in a special box.

7. Forty-eight of the dairies delivered milk once a day and twenty-five twice a day.

8. Sixty-eight used water to help cool the milk.

9. Eighteen made ice for their own use.

10. Seven had part of the storage box partitioned off to store foodstuffs.

11. Only four were not satisfied with their plants; two because their plants were too small; one because his plant was too large; and one because he had a system which did not keep his box at a uniform temperature.

12. Fourteen had had repairs which consisted mainly of minor adjustments and replacements of small parts.

13. The number of cows per dairy varied from 15 to 370 with an average of 85 for those using ammonia machines and 41 for those using sulphur dioxide or methyl chloride machines.

14. The quantity of milk cooled per day varied from 42 to 1100 gallons with an average of 235 gallons for the ammonia machines and 124 gallons for the sulphur dioxide and methyl chloride machines.

15. The rated capacity in tons of ice per 24 hours varied from 0.25 to 4 with an average of 1.6 for the ammonia machines; and from 0.167 to 0.500 with an average of 0.35 for the sulphur dioxide and methyl chloride machines.

16. Ages of the ammonia machines varied from 2 months to 6 years with an average of 2.4 years, while the age of the sulphur dioxide and methyl chloride machines varied from 1 week to 2 years with an average of 0.7 year.

17. The general tendency was to cool the milk to 40 degrees (Fahrenheit) and maintain the storage box at the same temperature.

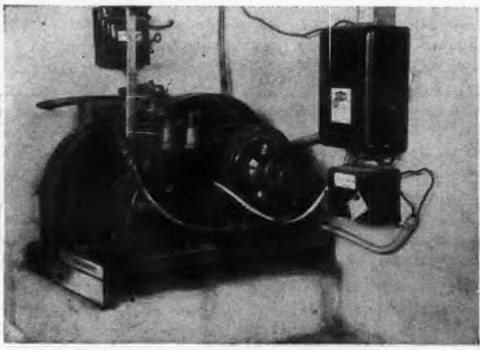
18. The quantity of milk cooled per day per ton rated capacity of compressor varied from 33 to 900 gallons with an average of 177 gallons for the ammonia machines, and 84 to 1440 gallons with an average of 383 gallons for the methyl chloride and sulphur dioxide machines.

19. The quantity of brine per gallon of milk per milking varied from 1.1 to 19.0 gallons with an average of 5.5 gallons.

20. The quantity of milk cooled per hour varied from

[1]A research study conducted by the author under the direction of A. W. Farrall and B. D. Moses.

[2]Field engineer, California Committee on the Relation of Electricity to Agriculture. Assoc. Mem. A.S.A.E.



(Left) An automatically controlled sulphur dioxide compressor used for cooling milk in a twenty-cow dairy. A service recorder is attached to the cylinders to determine the running time per day during a test. (Right) Milk house and milking shed on the L. N. Irwin ranch near Davis, Calif. The barn is capable of holding 10 cows at a time. Mr. Irwin uses a ¼-ton ice machine to cool the milk from his 20 cows

(Left) Brine pump and aerator used for cooling milk from 30 cows on the J. Davis dairy farm near Dixon, Calif. Note the automatic can tipper which is operated by a float suspended in the can. (Middle) Storage box with brine tank suspended from ceiling to allow cans to be placed underneath. The storage box is 4x6x7 feet and the brine tank contains 150 gallons of calcium chloride brine. The morning's milk from 30 cows is stored until evening when it is shipped approximately 75 miles by truck. (Right) Direct expansion type aerator used for cooling milk on the C. Casselman dairy farm near Sacramento. Mr. Casselman milks 72 cows and has a one-ton ice machine

11 to 110 gallons with an average of 35 gallons. The rate of cooling depended upon the rate of milking. The milk was usually started to cool at the beginning of milking and ended when milking was completed.

21. On many of the smaller dairies where only one man did the milking, there was a tendency to have an oversize aerator.

22. The average time required for milking was between five and six hours.

23. The initial costs of the complete plant varied from \$325 to \$3500, with an average of \$1630, for the ammonia machines, and \$400 to \$1450, with an average of \$930, for the sulphur dioxide and methyl chloride machines.

24. The initial cost of the complete plant per gallon of milk cooled per day varied from \$2.80 to \$35.00, with an average of \$10.40, for the ammonia type, and \$2.00 to \$19.00, with an average of \$8.50, for the sulphur dioxide and methyl chloride machines.

Power Consumption. During the survey, one to five representative plants in each vicinity were selected for power consumption tests. Through the cooperation of the power companies, watthour meters were installed on the compressor motor and in some cases on the brine pump motor also, on twenty-six different dairies. Data for all the dairies has not been obtained complete up to date. An idea of the power consumption for the summer months may be had, however, from the following:

In four dairies in the vicinity of Fresno, the power consumption by both the compressor and brine pump motors varied from 0.047 to 0.205 kilowatt-hours per gallon of milk cooled during the months of June, July, August and September. The average for the four dairies was 0.135 kilowatt-hours per gallon. Assuming the power rate as 2 cents per kilowatt-hour, this would amount to 0.27 cent per gallon of milk cooled.

In five other dairies, the power consumption of the compressor motor only during May and June varied from 0.043 to 0.260 with an average of 0.140 kilowatt-hours per gallon of milk cooled. At 2 cents per kilowatt-hour the average cost of power for the compressor in these dairies was 0.28 cent per gallon of milk.

Operating Characteristics. Six different plants were selected in the vicinities of Davis and Sacramento for carrying on the investigation of operating characteristics. It was decided to conduct a series of four one-week tests on each plant, one each in the summer, fall, winter and spring.

Some conclusions that can be drawn from the results of the summer and fall observations are:

1. The running time per day of the compressor depends upon its size. In the summer test of the six machines tested, which varied in size from ¼ ton to 1½ tons, the running time varied from 7.4 to 19.3 hours per day.

2. The running time per day of the compressor is dependent upon the gallons of milk cooled. This is well illustrated during the summer tests by comparing Dairies 5 and 6 which have the same make and size compressor. Dairy 5 was cooling 71 gallons of milk with a running time of 11.9 hours, while Dairy 6 required 19.3 hours to cool 213 gallons approximately only one-half as many degrees.

3. The running time per day is dependent upon the number of degrees the milk is cooled by machine. This point was brought out during the summer tests on Dairies 3 and 4. Dairy 4, which was cooling less milk and had a larger compressor than Dairy 3, but cooled the milk twice as many degrees, required a running time of two and one-half hours more per day.

4. The running time is dependent upon the temperature difference between the air inside and outside of the storage box. This point is brought out by Dairies 1 and 4. Comparing the results of the summer and fall tests for these two machines, it will be seen that Dairy 4, which had a difference between storage box temperature and the outside air temperature of 37 degrees during the summer test and 19 degrees during the fall test, ran 2 hours less per day during the fall test even though it was cooling more milk. Machine No. 1, on the other hand, ran

approximately the same number of hours during each test with the difference in storage box temperature and outside air temperature the same. Although 10 gallons per day more milk was cooled during the fall test on this dairy, it was cooled 7 degrees less than in the summer test, and the load on the machine was approximately the same.

5. The running time is dependent upon the size and insulation of the storage box. It was shown in the discussion of the previous conclusion that the machine on Dairy 4 ran 2 hours more during the summer test than during the fall test. It will be noticed, however, that this dairy has the largest storage box, 462 cubic feet, and the poorest insulation, a 4-inch layer of rice hulls. As a consequence the effect of the air temperatures is more marked. Dairy 2, on the other hand, has a small box, 75 cubic feet, and good insulation, 4-inch sheet cork; but the difference in running time between the two tests was only 1.2 hours even though during the fall test 5 gallons per day less milk were cooled and the milk was cooled 2 degree less than during the summer test.

6. Twenty-five to fifty-four per cent of the plant load is produced by the heat removed from the milk. This is shown by the ratio of the heat extracted from the milk to the heat extracted from the plant by the compressor, providing the compressors were operating at rated capacity.

7. The larger the percentage of the load produced by the heat removed from the milk, the greater will be the number of gallons cooled per degree per hour of operation per unit rated capacity of the compressor. By examining lines 17 and 19 in the table it will be seen that the gallons of milk cooled per degree per hour of operation per ton rated capacity varies with the ratio of the heat extracted from the milk to the heat extracted from the plant by the compressor.

8. A comparison of the performance of these machines upon a rated capacity basis does not agree with a comparison upon a power consumption basis. By examining Lines 17, 18, 19 and 20 in the tables it will be noticed that Machines 3 and 4, when compared on a rated capacity basis are the poorest, and when compared on a kilowatt-hour basis are the best.

SUMMARY OF RESULTS OF INTENSIVE TESTS ON REFRIGERATION MACHINES USED FOR COOLING MILK ON SIX DIFFERENT DAIRIES IN THE VICINITY OF DAVIS AND SACRAMENTO

	Dairy Number	1	2	3	4	5	6
	SUMMER TEST						
1	Rated capacity of compressor in tons of ice per 24 hours	1/4	1/4	1.0	1½	3/8	3/8
2	Dimensions of storage box (inside) in feet	4x4x7	3x5x5	5x6x6½	6x11x7	4x6x7	6x6x7
3	Size of storage box in cu. ft.	112	75	195	462	168	252
4	Insulation used in storage box *	3"S.C. 4"R.H.	4"S. Cork	6"G. Cork	4"Rice Hulls	3"S. Cork	6"Rice Hulls
5	Gallons of brine	120	190	0	350	150	200
6	Cost of complete plant	$800	$1150	$1450	$1500	$1100	$1200
7	Date of Test	Aug. 13-18	July30 Aug.4	Aug. 6-10	Aug. 7-11	July 23-27	Aug. 13-17
8	Ave. gallons of milk cooled per day	54	84	225	214	71	213
9	Ave. gallons of milk stored per day	28	42	113	111	37	103
10	Ave. hours compressor run per day	10.3	13.4	7.4	9.9	11.9	19.3
11	Ave. Kw-hr. used per day by compressor & brine pump	10.2	9.0	7.1	24.9	14.3	22.5
12	Ave. brine temperature **	18			25	20	22
13	Ave. storage box temperature	32	45	50	40	37	43
14	Ave. temperature inside milk house	73	79	77	77	75	71
15	Ave. temperature milk cooled to	36	44	52	47	39	42
16	Ave. degrees milk was cooled by machine	38	31	13	26	39	22
17	Gallons of milk cooled one degree per hour of operation per ton rated capacity	800	780	382	390	625	649
18	Kw-hr. consumed per gallon of milk cooled one degree	.0048	.0035	.0025	.0043	.0052	.0048
19	Ratio of heat extracted from milk to total heat extracted by compressor (based on rated capacity and running time)	.54	.52	.27	.25	.42	.44
20	Ratio of heat extracted from milk to heat equivalent of the energy input to compressor motor and brine pump motor. (Based on Kw-hr. consumed).	.47	.68	.97	.53	.47	.49
	FALL TEST						
7	Date of test	Oct. 15-20	Oct. 15-19	Oct. 22-26	Oct. 22-26	Oct. 13-17	Nov. 5-9
8	Ave. gallons of milk cooled per day	54	79	189	233	73	120
9	Ave. gallons of milk stored per day	33	39	98	133	38	60
10	Ave. hours compressor run per day	10.2	12.2	6.3	7.9	9.1	12.2
11	Ave. Kw-hr. used per day by compressor and brine pump	10.0	8.3	6.2	17.8	10.7	16.3
12	Ave. brine temperature	12			20	23	20
13	Ave. storage box temperature	28	44	45	39	36	40
14	Ave. temperature inside milk house	69	69	59	58	67	58
15	Ave. temperature milk cooled to	35	43	44	46	37	35
16	Ave. degrees milk was cooled by machine	31	29	18	26	34	28
17	Gallons of milk cooled one degree per hour of operation per ton rated capacity	779	752	540	512	730	740
18	Kw-hr. consumed per gallon of milk cooled one degree	.005	.0036	.0018	.0029	.0043	.0049
19	Ratio of heat extracted from milk to total heat extracted by compressor (based on rated capacity and running time).	.53	.50	.36	.34	.49	.50
20	Ratio of heat extracted from milk to heat equivalent of the energy input to compressor motor and brine pump motor. (Based on Kw-hr. consumed.)	.47	.65	1.30	.81	.55	.49

* (S.C.) = Sheet Cork (R.H.) = Rice Hulls (G. Cork) = Granulated Cork.
** All temperatures expressed in degrees Fahrenheit.

Criticisms by Dairymen. During this investigation opportunity was had to hear numerous criticisms and remarks made by dairymen in regard to their refrigeration machines. One dairyman bought a machine which was to be completely installed and was guaranteed to cool 200 gallons of milk per day. After having the machine set up, it was necessary for him to hold back payments to get the seller to make the necessary wiring and power connections for operation.

In another dairy, when the milk was cooled by the refrigeration machine, it was frozen on the aerator, and the creamery objected because the milk showed no cream line. All that was necessary to correct this fault was to open a valve a little wider. When told this, the dairyman stated that the engineer when installing the plant would give him as little information as possible about its operation.

In another dairy the dairyman, who knew very little about refrigeration, accepted a salesman's plans and specifications. The result was that he was sold a plant about three times larger than he needed. He has a $3500 plant to cool 150 gallons of milk per day.

Another dairyman, when he wanted to buy a refrigeration machine, found that the sizes recommended to him by the various salesmen varied from ¼ to 1 ton. He also found that several of the salesmen, when they found out their competitor's bids, offered to sell him a smaller machine at a lower price in order to make a lower bid.

All the comments and criticisms made were not against the machines or their salesmen. As shown in the survey nearly all of the dairymen were satisfied with their plants. Several dairymen stated that the monthly installments on their refrigeration machines amounted to less than the amount they previously paid for ice. In general the comments favorable to the operation of the machines greatly outnumbered the unfavorable coments. Appreciation was often expressed for the service given them on the machine by the seller. It was also noticed that many of the dairymen took much pride in telling of the work of their refrigeration machines.

CONCLUSIONS

Results of this investigation so far seem to indicate that the big problem in dairy refrigeration is the selection of the proper size of plant. In order for this to be possible it seems necessary:

1. That the refrigeration machine manufacturers rate their machines upon a standard basis and in terms understandable to the average dairyman.

2. That the salesman of these machines know and tell the dairymen within a reasonable amount the quantity of milk they will handle under the conditions in which they will operate.

3. That as much help as possible be given the dairyman in designing his storage box.

Farm Fencing Needs Economic Engineering Study

By F. A. Lyman[1]

A CLOSE study of the use, value and need of fence on the present day farm leads the student to believe that the proponents of power in agriculture, diver sification, crop and livestock rotation and the utilization of farm wastes and by-products are in much the same position as the fire chief in a Chicago suburb who recently engineered the purchase of a new fire engine of the latest type and then found that his fire house was too small to hold the engine when it arrived. The engine was delivered all right, but it had to be stored until the fire house could be rebuilt. A gratifyingly large percentage of farm operators have been "sold" the idea of modern methods of farm management and operation, but the salesmen have neglected to include in the package the little gadget which is necessary to get the machinery started.

A majority of the "modern" methods of crop, soil and livestock management require the proper use of fence before they can be profitably practiced. This enabling factor, however, has been quite completely buried beneath the glamour of more interesting and imaginative equipment and ideas.

Such a study further reveals—in this day when economics and economic application is of major importance in every enterprise and industry—that the vast majority of investigations until very recently have covered only the mechanics of fencing and have done but little to uncover the monetary value of fence on the farm and in the various types and classifications of farming. What knowledge we do have has been secured indirectly—as a by-product of other projects. If this knowledge can be obtained as a by-product, so much the better, but it is evident that the by-products usually are allowed to accumulate a thick covering of dust if not actually to molder away.

It would be folly to claim that the widespread promotion by numerous educational and commercial agencies of the McLean County system of hog sanitation, for example, has not had its effect on the promotion of an economic use of fence. But the lack of a knowledge of the monetary value of fence to the farmer who practices this system has a very direct influence in delaying or preventing its general adoption. The farm operator has been encouraged from many directions directly and indirectly, and trained in the belief that fence is never anything but an expense—a necessary evil—which should be avoided as much as possible. Hence, he hesitates to put into practice any method or plan which calls for the use of fence—and patches and patches his old until he has spent more time and labor than the fence is worth. He learns that he should rearrange his fields to make possible a definite program of soil-building crop rotation and to make more economical and profitable the use of larger power units and larger units of machinery. But as soon as he gets out pencil and paper and starts—in the words of J. M. Dowell—to "figure out a new farm," he immediately becomes discouraged at the thought of having to replace a portion of his fence—because his present fences in 80 per cent of the cases will be too old and rotten to move—and of making the additional investment required, even though he will reduce his operating costs materially.

Manufacturers of farm fence have realized this situation, both from choice and from necessity. By choice, because effective selling of essential commodities is done on an economic basis of consumer benefit, and from necessity because of the sharply decreasing tonnage of fence sales within the last 15 years without an increase corresponding to recent increasing sales of other commodities in the productive, semi-luxury and luxury classes. Fence Manufacturers have, within the past three years, adopted almost without exception an economic type of sales promotional program but immediately found themselves confronted with a serious handicap of an almost complete lack of constructive economic information. As a result, the Farm Fence

[1]Managing director, Farm Fence Institute. Assoc. Mem. A.S.A.E.

Hogging down corn is a profitable farm practice becoming more widely adopted each year. As is true of other methods of crop, soil and livestock management, this practice calls for adequate fencing. As a matter of fact, fencing to meet the requirements of any farm practice or of the farm in general is a problem of greater importance and significance than is generally considered. Farm managers and engineers are beginning to give it the attention and study it merits

Institute was organized early in 1929 to make as complete and exhaustive study of the value and use of fence as possible and at the same time to analyze the need and potential market for fence, territorially and by classes of farms and farming. What type of farming, for instance, requires fence to return the greatest profit and what type of farming returns the greatest profit on the fence investment? In what types of farming does fence return a substantial dividend and in what types is it uneconomical? What type of farm, over the widest area, returns the greatest net profit under competent management? What is the benefit of adequate fencing, properly used, in building up the fertility of the soil? In what territories are economic and physical conditions making necessary a change in the type of farming—more specifically, a diversified soil-building system in contrast with a one-crop system? What is the economic—the profit-producing—length of life of fence and how long is it actually used? What is the most economical and profitable type of fence under different systems of farming and in different territories? And so on.

It is an interesting study. It touches intimately almost every problem and phase of farm management—livestock production, crop and livestock rotation, soil building, use of power and machinery, utilization of crop wastes and residues, labor efficiency—in all of these is the economic use of fence of great importance. Furthermore, the economic use of fence stimulates the adoption and use of other equipment.

The problem of rearranging the farm layout in keeping with present day mechanical and economic demands is an interesting example. It is more or less fundamental to profitable farm operation, depending to some extent upon the territory and type of farming. The Farm Fence Institute has secured more than a thousand layouts of existing farm field arrangement in the course of its surveys. Roughly, 85 per cent of these farms have a high percentage of small fields, many irregular in shape in spite of the fact that surrounding fields are tillable and, hence, present no topographical necessity for the irregularity. One 80-acre Illinois farm coming under the "general farming" classification has 23 fields, with only four major crops. The operator has a tractor and presumably tries to use it profitably for power field operations. Obviously, it cannot be done. No system of crop rotation can possibly be practiced with such a conglomeration of "patches"—one can hardly call them fields. To fence a sufficient number of these fields to rotate livestock would be prohibitive in cost.

This is an unusual example, painting in vivid fashion what is probably the poorest example of farm management possible to find. Yet a majority of farms using some or all of the latest modern equipment to reduce labor costs and increase the margin of profit are striving to do so under a handicap of a field arrangement which was used when four horses was the largest power unit used.

When a farm operator starts to "figure out a new farm" he may be impelled to do so by a desire to start a definite system of soil-building crop rotation. Or, in the process of his study, he may realize that the way is thus laid open to a simplification of crop and livestock effort. Whatever the motive may be, the result is almost sure to be an improved system of crop, soil, livestock and equipment management. If he has been on a grain farming basis, he will in all probability add a livestock enterprise or two. As a result, he will want a silo, an ensilage cutter, stock tanks, hog waterers and other equipment. If he has been using horses, he will the sooner realize that his new layout will make tractor operation more economical and will need additional equipment to use with the mechanical power unit. Thus we find the field rearrangement idea a basis for the many new practices widely advocated by educational institutions, extension workers, farm papers, commercial organizations and the many others striving for one reason or another to improve the quality of farm management and operation.

An Outline of Some Economic and Mechanical Problems Relating to the Construction and Use of Farm Fence

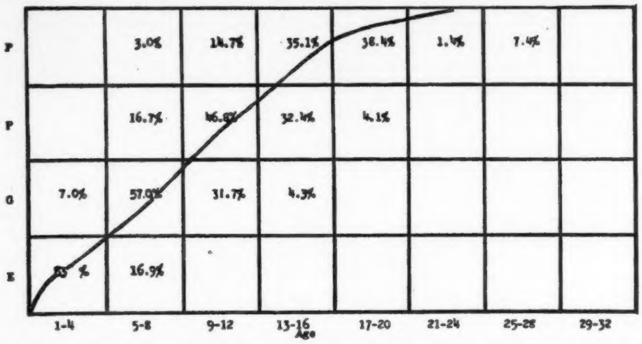
I. Analysis of existing fences to learn
   A. Extent
   B. Condition
   C. Replacement needed
   D. Economic length of life compared with actual period of use
   E. Extent of non-metal fences
II. Economics of fencing
   A. Income-producing value of fence in different farming systems
   B. Relation of fence to profitable livestock production
   C. Relation of fence to maintenance of soil fertility
   D. Relation of fence to labor economy
   E. Relation of fence to economy of equipment operation
   F. Relation of fence to farm valuation
   G. Relation of fence to tenant problem
      1. Profit to tenant
      2. Profit to landlord
         (a) Ability to secure good tenants
         (b) Increased income
   H. Investigation of fence markets by class
   I. Relation of fence to increased farm production per unit (acre) and per worker
      1. Crop rotation
      2. Soil fertility
      3. Efficient and economical animal production
      4. Field arrangement
   J. Relation of fence to sales value of a farm as affects
      1. Mortgage bankers
      2. Local banks
      3. Insurance companies
      4. Individuals
   K. Economic length of life of fences
   L. Value and uses of temporary and permanent fences
III. Mechanics of fencing
   A. Suitable types for various uses
   B. Construction
   C. Maintenance
   D. Comparative study of posts by materials and uses

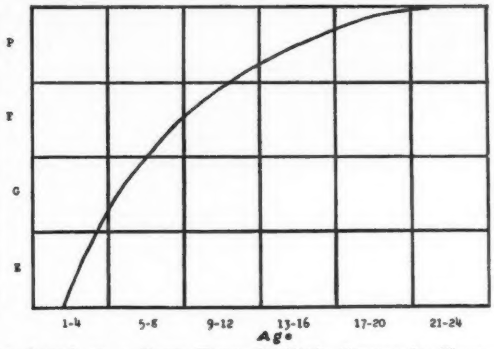
With the new system in operation, his capital investment in land will be the better protected from deterioration through inadequate soil management, while his income will be increased through the addition or simplification of his farming enterprises and the leveling of labor and equipment peaks.

The Farm Fence Institute surveys, in the brief analysis which has been possible to date, show existing fences quite uniformly below par in operating efficiency. This is further supported by the fact that the tonnage of fence sold over a period approximately the life of good fencing, as far as can be determined to date, has been entirely inadequate for normal relacement needs. This is indicated in the preliminary report of the survey conducted by the Institute in Illinois, one of the "best fenced" states. This survey was made by R. W. Wright, a senior in the Department of Farm Management at the University of Illinois, and under the cooperative direction and advice of Prof. H. C. M. Case, head of the department of farm management, and Prof. E. W. Lehmann, head of the department of farm mechanics. Four townships, one each in a typical farming section of the state, were selected and completely mapped to show the kind, condition and extent of the fences and fence posts now in existence. This automatically gave the field arrangement plan of every farm in the four townships.

In his preliminary report Mr. Wright says: "One of the outstanding observations made on this survey was the large number of farms which are poorly organized. It appeared that a majority of farmers just farm from year to year without any thought of rotation or a definite soil improvement plan. Very few farms have a good field layout. It seems that only a few farmers realize the economies that a well-organized and well-fenced farm effect.

"The survey shows that a large number of fences are in poor condition. In some places the fences are almost





(Left) A graph correlating the age with the condition of woven wire fence, based on a Farm Fence Institute Survey in Champaign County, Illinois, in 1929. Age groupings are by years and the curve passes into a "Poor" at approximately 15 years. Condition of the fence is indicated as follows: P, poor (fence which needs replacing at once); F, fair (in need of some repair but not useless); G, good; E, excellent. (Right) A graph correlating the age with the condition of barb wire fence, from the same survey

normal in replacement, but these are in the more progressive areas. On the whole, the farm owners and operators must be shown that they are in need of fence. In McHenry County, for example, I interviewed a farmer who owned 160 acres of good farming land. There were no field division fences, no fence along the road—just a poor pasture fence and boundary fence. He said he knew he needed new fences, but could not afford to buy the fence he should have to carry on a profitable system of farming. However, he had a new car in his garage."

Going to more specific data, Mr. Wright found: "In Champaign County (typical of the grain farming area), 60.9 per cent of the fence is barbed wire. The average age of the woven wire that is standing is 10.5 years and that of barbed wire 8.5 years. A graph correlating the condition of the fence with the age shows that the barbed wire should be replaced at approximately 14 years of age and the woven wire at 15 years. As could be expected from the large amount of hedge in this county (14.8 per cent), 58.2 per cent of the posts are osage orange. Only 4.4 per cent of the hedge posts are in excellent condition, while 49.1 per cent of the steel posts are in the "excellent" (fence and posts were classified "excellent, "good", "fair", and poor") classification, which tends to show that a large majority of the steel posts are new.

"The summary for Effingham County (mixed farming) shows 77.5 per cent of the fence is barbed wire, and of that 62.8 per cent is in poor condition. The average age of the barbed wire that is standing is 19.3 years and that of woven wire 16.8 years, indicating that the replacement status of fence in this area is less than 50 per cent of normal. The average size farm in this area is 122.9 acres, with an average of 513.5 rods per 160 acres jointly owned. Of the fence jointly owned, 74.6 per cent is barb wire and 59.2 per cent in poor condition."

This data checks a point brought out in an Institute survey made in Minnesota which showed that field division fences were uniformly in better condition than farm boundary fences. Mr. Wright observes: "I should think the farmers would want a good fence between them and their neighbors."

"The summary for Knox county (corn and hog area) shows that 51.5 per cent of the fence is woven wire and is about normal in replacement. This is probably due to the introduction of the McLean county system of hog sanitation for raising hogs.

"In McHenry county (dairying), 78.6 per cent of the fence is barb wire. Only 3.8 per cent is in excellent condition. The average age of the woven wire is 14.7 years and that of barb wire 15.4 years."

Another view of the fence situation over a wide area was obtained from the general agricultural development agents of a number of railroads and from their maintenance of way departments.

Arthur W. Large, general agricultural agent of the Chicago, Rock Island and Pacific Railway Company, says: "You undoubtedly know that there has been a great movement throughout the country to do away with farm fences. A trip of any extent along our principal highways will quickly confirm this statement. I simply cite this as a fact and not as a farm practice which commands the approval of myself or others who have given consideration to the matter.

"Livestock cannot be cared for properly or satisfactorily without good fences, and inasmuch as livestock, with crop rotation, is the foundation of the maintenance of soil fertility in our own and other countries, the conclusion is inescapable that good farm fences are indispensable to good farming. . . . . There is no question but that the condition of farm fences throughout our territory is far below what they should be for the best and most profitable use of the land."

The trend toward diversification in territories formerly devoted largely to one crop is shown in this extract from a letter from D. S. Colby, superintendent of the Northern Pacific division at Jamestown, N. D., "We are getting more requests now for converting stock fence into hog or sheep tight fence, indicating that farmers are raising more sheep and hogs than cattle and horses. In 1928 we built 13 miles to tight fence and 6 miles of stock fence compared with 5 miles of tight fence and 27 miles of stock fence in 1918."

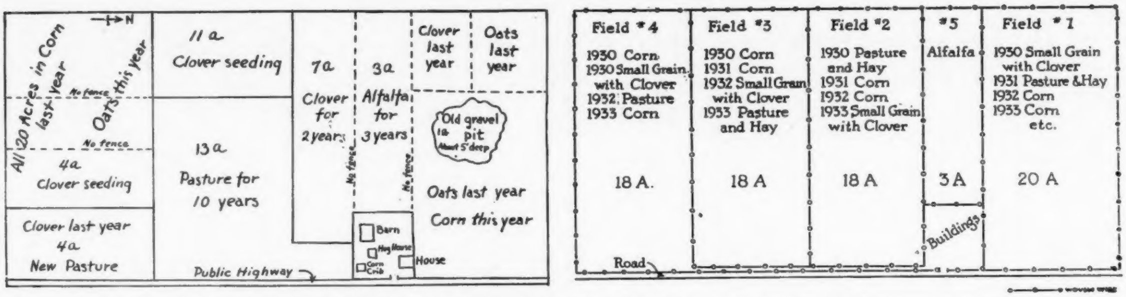
This statement is further confirmed by similar data from Ralph W. Reynolds, commissioner of agricultural development and colonization, Chicago, Milwaukee, St. Paul and Pacific Railroad Company.

Russell G. East, agricultural agent, Pennsylvania Railroad, says: "I would say that there is a decided tendency on the part of farmers to use woven wire fence instead of barb wire, and of a heavier type wire than formerly.

"There is a decided need for more and better fences. No part of the farm equipment has been allowed to deteriorate quite as much as farm fences."

Data from the maintenance of way departments indicates a working life of 10 to 15 years for fence in the more humid sections of the country—east, south and middle west—and from 15 to 25 years in drier regions such as the Northwest. As might be expected, these data vary from railroads in the same territories, but not as widely as general estimates in common circulation. Almost uniformly the railroads use a heavier fence than the majority of farmers. Eastern and middle western roads report a decided tendency toward the use of steel posts both on their own lines and adjoining farms, while railroads with large timber holdings use wood posts almost altogether.

Another angle on the need and trend toward diversification in the Northwest is contained in a letter from a field editor of one of the well known farm papers of that territory. He says: "From my observations of agricultural conditions in western Minnesota, North and South Dakota, I would say that the surface has barely been scratched in the trend toward greater diversification. A



A Bremer County (Iowa) farmer became interested in rearranging his fields and asked for suggestions "as soon as you can, as I want to get to fall plowing." The diagram at the left shows his present field layout, and the one at the right the suggested plan. Outside of any necessary drainage of the pasture, the revised plan calls for no changes beyond simplifying the field arrangement and the gradual filling of the abandoned gravel pit by scraping in the sides and farming over it

few of the more progressive farmers have made a substantial start in the production of livestock and crops which are usually produced to feed it. Many others have come to the point where they are ready to admit they must keep livestock to supplement their present system of crop farming. A prominent livestock breeder said to me recently, 'Many hardshelled wheat farmers who never before were willing to concede that livestock is necessary have told me within the last year that they cannot farm without livestock.' . . . . The sow thistle, as you know, is confined chiefly to the Red River Valley district. It is forcing farmers to adopt diversification and better farm management practices much more rapidly than they would otherwise. . . . . The manager of a 15,000-acre farm in North Dakota is planning, as soon as possible, to fence all of the land which is under his management. Another North Dakota landowner has fenced every acre of his several hundred acre farm. . . . . In my opinion, the problems of selecting fencing materials and type of fence construction are among the most important which Northwestern farmers have to solve. Very little investigational work is being done along this line in our northwestern agricultural colleges."

From Texas: "Root rot is driving out cotton and dairying is coming in. This means that pastures must be fenced and that crop rotation must be practiced, including in the list many temporary pasture crops. Years ago when the counties passed livestock laws forbidding cattle on the right-of-ways, the farmers were engaged largely in the production of cotton and, therefore, did not need fences. There being no danger from livestock on the public highways, they let their fences run down or tore them up. These must be rebuilt to make the land productive under the new program of management which must be followed."

The farm mortgage banker, the insurance company, and the farm manager who specializes in managing properties for financial institutions want to know how far the latter should go—or can go—in renovating permanent equipment such as fences and buildings in order to make the farm more salable and at the same time protect the additional investment. A banker in a middle western town recently told the writer that he has been buying rundown farms as a personal investment, immediately returning the first two or three years' income to the land in the shape of limestone, fertilizer, fences and building repairs. The last farm which he purchased and started to improve had a list of forty applicants from prospective tenants. "I believe this is the only way to protect our investment in lands which the bank has had to take over, and from a personal standpoint, the farms which I have purchased. If this additional investment is not made as the initial step of placing the farms on a constructive basis of farm management, our investment will dwindle away from year to year as the soil is mined and allowed to wash away. The better tenants will desert the poorer farms, resulting in a poorer class of tenants each year, with a resulting annual decrease in the productive value of the farm."

The banker's statement applies with equal force to the individual landlord who feels that he cannot afford to keep fences and other equipment in a productive state of repair. If he does not make it possible for the tenant to follow a system of farm management which will protect the capital value of the farm and increase the income, his capital and income will gradually dwindle away. The seriousness of this problem can be realized from a brief glance at the figures on percentage of tenancy in even our most productive states.

The problem of proper fence application and management is fundamental in the success or failure of farming throughout the major portion of our productive agricultural area. Present day economic tendencies indicate that it will become more important in the future. It is a problem worthy of careful and extensive study, and as such is commended to the attention of the agricultural engineering profession.

Elevators Speed Up Cribbing and Binning

THE farmer who produces corn and small grains under modern methods is oft-times hampered in his work because of inadequate, or in many cases lack of, cribbing and binning machinery. Scooping corn into low cribs or wheat into a driveway bin was all right when acreages were small and elevators were not available, but this practice now is both expensive and difficult. Use of the combine-harvester and corn picker-husker have cut harvesting costs and speeded up harvest so much that storing grain by hand is often a limiting factor if labor is scarce, or if labor is available, an expensive operation.

Two principal types of steel elevators are now made. One is the portable type, the other an inside cup elevator. Portable styles have been improved until they are lightweight, but exceptionally strong; easily moved; and efficient in operation. Horse power or belt power can be used. The latter may be furnished by a gas engine or tractor. The portable elevator may be pulled over the farm on its own wheels, and will elevate corn, wheat, oats or other small grain. Farmers find that with the aid of this machine one man can easily unload grain from a combine or corn picker-husker.

Inside cup elevators are usually installed in combination corn cribs and granaries. In a crib of this kind the dump is installed in the driveway. Either a pit dump or a hoist dump may be used. The steel elevator shaft runs upward on one side, and at the top a swinging delivery spout sends the grain or ear corn into any bin. The inside cup elevator is operated with belt power and may be installed in an old or new barn. The complete outfit is simple, and will last a lifetime.

Electricity for the Artificial Incubating and Brooding of Chicks[1]

By J. E. Dougherty[2]

ELECTRICITY as a source of heat for the artificial incubation and brooding of chicks has proven very popular with poultry keepers on the Pacific Coast because of its convenience. Only two obstacles stand in the way of it being used much more extensively than at present. These are dependability and high cost of current. Wherever the electric power companies reduce the liability of interruption to the supply of current from a major to a minor hazard and reduce the net cost to compare favorably with other sources of heat, electric heating will probably displace other methods of heating incubators and brooders wherever it is obtainable for such purposes.

Electric heating differs from other methods in two very important ways: (1) The air is not vitiated by the combustion of fuel, and (2) the heat can be turned on and off by an automatic, thermostatic breaker as frequently as is necessary to maintain any desired temperature. In the case of oil and coal-burning incubators, vitiation of the air entering the egg chamber is also prevented by the separation of the ventilation system of the egg chamber from the air supply of the heating device. Convenience, reduced fire hazard and unit expansion represent the real advantages of electric incubators over those heated in other ways.

Electricity makes for convenience because it eliminates the filling of lamps, trimming of wicks, tending coal heaters, etc. The same would be true of gas. But when it comes to a reduction in fire hazard, there can be no question but that an electric heating system properly installed is superior to most others. A hot water system with the heater in a separate, concrete, fireproof room would, perhaps, offer as little fire risk as electricity but would lack the advantage of possible unit expansion.

A properly installed electric heating installation for incubators is one in which all wiring conforms to the recognized standards for safety against fire and accident. It is one in which the heating units operate at a "black heat." It is one in which the arcing at the breaker points of the thermostatic breaker is reduced to a negligible danger by the use of the right kind of contacts and, if necessary, by cutting in a condenser across the breaker points.

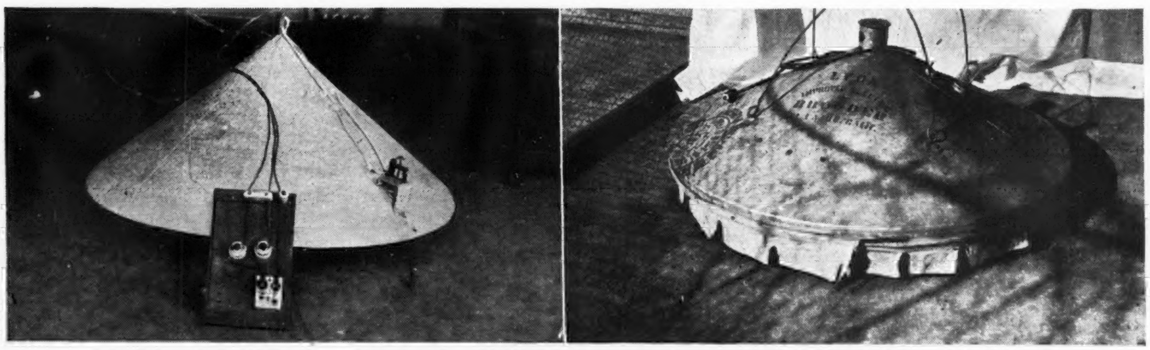
Unit expansion permits of the multiplication of small units without increasing labor or otherwise affecting convenience of operation. For example, suppose a poultry keeper wishes to do his own hatching or to sell day-old chicks in a small way and he can buy a few good, 500-egg size, lamp-heated incubators. Filling and trimming a moderate number of lamps does not prove a serious chore. But his hatching requirements expand; more lamp machines are purchased from time to time as he can afford them, until caring for the lamps becomes a distinct burden. Finally he decides to sell the small machines and install a mammoth and eliminate the lamp filling and trimming job permanently. Unfortunately, changing from small machines to one or more mammoths is not a solution of all of the problems involved. There may be many times when the mammoth cannot be set to over half-capacity. In the case of the forced-draft or agitated-air types of incubators only one-third of the egg capacity of the machine can be hatched at any one time. This might not be a disadvantage to hatcheries selling chicks. It might, however, be a very serious disadvantage to the large poultry keeper doing his own hatching and who either is not equipped to brood a new lot of chicks each week or who finds it less expensive to brood in only one or two large lots a season.

There is the further question, with the forced-draft and agitated-air types of incubators, of effective disinfection to prevent the dissemination of bacillary white diarrhea infection. With only one-third of the eggs hatching at any one time, the incubator is never empty during the hatching season. Vigorous scrubbing and disinfection with liquids is, therefore, not feasible after each hatch of chicks is removed as with natural draft machines. However, extended investigations have recently been initiated to develop effective methods of disinfecting forced-draft and agitated-air incubators and the results to date indicate that entirely satisfactory results can perhaps be obtained by gas disinfection at the proper times.

The electric incubator maintains all of its advantages irrespective of the number of units operated. The turn of a switch starts each heating unit to functioning. Once accurately set to the desired operating temperature (assuming that one temperature is maintained throughout the

[1]Paper presented at a meeting of the Pacific Coast Section, American Society of Agricultural Engineers, at Ontario, Calif., January, 1929.

[2]Associate professor of poultry husbandry, University of California.



(Left) An early model of the curtainless, "radiant-heat" type of electric brooder. This type of brooder has been materially improved in the latest models. (Right) A "black heat" electric brooder that is quite popular in California

hatch) a dependable thermostatic breaker should thereafter require further adjustment only at rare intervals. Hence, a poultry keeper can initiate artificial hatching with only one incubator and then add more from year to year without increasing labor or lessening convenience to a point where any benefits would be gained by replacing the small units with a mammoth machine. And every other operation, including turning, can be done practically as effectively in small units as in large ones. Further, no shifting of eggs is necessary on the eighteenth day as testing can be done the first week. The infertiles can then be gotten out and disposed of.

Since electric heating does not vitiate the air, one might suppose that its use for brooding would simplify the problem of obtaining adequate ventilation. As a matter of fact, the application of electricity to the heating of brooders soon revealed difficulties growing out of the very exact regulation of heat made possible and the popular conception of electricity as an expensive source of heat. Poultry keepers began using electricity for brooding in the belief that it was necessary to restrict ventilation and take advantage of the exact regulation of temperature to reduce the kilowatt-hours consumed to a minimum. This procedure was fostered by the knowledge that electricity does not contaminate the air as do oil, gas and coal.

Chicks give off carbon dioxide and moisture in breathing and considerable moisture, as well as unhealthful fumes, comes from the droppings. Restricting ventilation, therefore, brings about not only a depletion of oxygen and an increase in the carbon dioxide content of the air under the hover, but it also results in raising the moisture content of this air. Yet excessively high temperatures are not produced as would be the case if ventilation were greatly restricted in an oil, gas or coal-heated brooder. Under these conditions the air of the hover soon becomes saturated with water vapor; it cannot hold it all and the excess condenses on the cooler surfaces on and near the floor. The chicks are said to "sweat" because they feel damp to the hand. The floor may become quite moist and the lower part of the curtain, particularly if made of table oilcloth with the oiled side in, may become moist. This is a decidedly unhealthy condition that can be readily remedied by increasing the circulation of air through the hover.

Poultrymen have gone to the other extreme in their efforts to prevent sweating. They have resorted to curtainless hovers providing abundant ventilation and using an intense radiant heat aimed to keep the air under the hover always very dry. Radiant heat and no curtains may materially increase the consumption of electricity as compared with curtained hovers using black heat. It has also been found more difficult to design radiant hovers producing conditions of optimum comfort for the chicks, as explained in detail in June, 1927, Progress Report No. 3, of the California Committee on the Relation of Electricity to Agriculture. Improved reflectors and a reduction in the wire surface temperature of the heating elements have largely overcome the injurious "hot spot" conditions so common in earlier models as described in the report.

Probably the most feasible means of ventilating a brooder is by diffusion and the effectiveness of such ventilation will depend upon the size of the ventilation openings and upon the number and size of the chicks that are under the hover contaminating the air. A brooder holding a large number of chicks should, therefore, be more open than one holding a small number. The heat units consumed per chick will be practically the same no matter what the number of chicks under the hover may be.

A round or square hover with a curtain all around is more readily ventilated than a box hover open on only one or two sides as there is more open space through which air can pass in and out. But even in hovers with curtains all around, the ventilation may become deficient as the chicks grow, if the canopy is not raised a little higher each week to increase the circulation of air under it. The bottom of the curtain should hang from one-half to one inch above the floor when the chicks are first put in and should be raised approximately one-half inch per week as the chicks grow. Whether it is one-half or one inch above the floor at first and just how rapidly it is raised will depend upon the weather. The cooler the weather the greater will be the difference in temperature between the air in the hover and the air outside the hover. The rate of air movement in and out of the hover will be materially influenced by the amount of this difference, other things being equal. In autumn, winter and early spring weather, therefore, the curtain should hang closer to the floor at first and be raised less rapidly than in the warmer weather of late spring.

Electric brooding has suffered from an overzealous effort to restrict power consumption without a due appreciation of the effect on ventilation. It has suffered from an attempt to make ventilation proof against ignorance and mishandling. It has suffered from the misguided efforts of those who have attempted to design, manufacture and market brooders basically wrong in principle or brooders of good basic design poorly developed and constructed.

The sale of brooders basically wrong in design always gives an unfortunate setback to the sale of brooders of good design. Flimsy construction makes for rapid depreciation; poor insulation causes a wasteful increase of power consumption; inconvenience in design and construction increases operating costs. The addition of "jim cracks" and "doo dads" that increase the cost of manufacture of a brooder without making it a more valuable tool for its purpose represents economic waste.

Simplicity, durability, accuracy of regulation, effectiveness of ventilation, effectiveness of insulation, convenience for operation, cleaning and repairing these are the characteristics of a good electric brooder. A brooder is a tool for a very definite purpose and its value depends on its ability to serve that purpose to the fullest extent.

How a number of different makes of brooders compare in fuel consumption when operated under exactly similar conditions by one man during November in California and so handled as to provide good ventilation, is shown in the accompanying table.

Kilowatt-Hours Consumed by Each of Five (5) Different Electric Brooders Operated at the Same Time Under Similar Conditions

Period	Kilowatt-hours Consumed				
	Curtain Brooder No. 1	Curtain Brooder No. 2	Curtain Brooder No. 3	Curtain Brooder No. 4	Curtainless Brooder No. 5
1st 10 days	31.4	37.4	101.5	154.5	66.9
2nd 10 days	28.7	31.1	68.1	136.7	70.3
3rd 10 days	24.7	23.7	38.8	115.9	73.2
4th 10 days	20.8	19.2	22.8	110.8	71.4
Total, 40 days	105.6	111.4	231.2	517.9	281.8

Brooders Nos. 3 and 4 operated at approximately one-half capacity for the first 20 days, and others at one-third capacity.

All brooders operated at approximately two-fifths capacity for the last twenty days.

Brooders Nos. 1, 2 and 5 are 42 inches in diameter. Brooder No. 3 is 56 inches in diameter, and Brooder No. 4 is 64 inches in diameter.

Types of Waste

IN A paper presented at the annual meeting of the Society of Industrial Engineers, Virgil M. Palmer grouped industrial wastes into three different classes as follows: (1) Waste occasioned through low yield, or inefficient use of consumable tools, accessories and supplies; (2) waste occasioned through failure to use the by-products from production operations; and (3) waste occasioned through the obsolescence of plant, equipment or product.

Class 1 he said is easily prevented at its source; while class 2 is most difficult to overcome but offers the greatest opportunity for profit. Class 3 he felt was largely justifiable as a price paid for progress.

Test of Corn Planter Fertilizer Attachments

By Ove F. Jensen[1]

THE Joint Committee on Fertilizer Application[2] has for several years made a careful study of various methods of applying fertilizers and of the farm implements used for their distribution. Based on definite agronomic research, recommendations have been made for the placement of fertilizer with reference to the seed for corn, small grains, and potatoes.

Field tests on corn have almost universally shown a greater economic return for hill or drill row application over broadcast application. As a consequence, the interest in and sales of fertilizer attachments for corn planters have increased very decidedly in recent years. One manufacturer reported recently that his sales of fertilizer attachments for 1929 had increased 34 per cent over 1928. Another manufacturer reported a 27 per cent increase.

Recognizing the inadequacy of many of the present day fertilizer attachments on corn planters, the Joint Committee on Fertilizer Application, under the chairmanship of Prof. Emil Truog of the University of Wisconsin, undertook a test of performance of planters for placement of fertilizer, accuracy of delivery, and other factors. The test was conducted at the University of Wisconsin on May 10 and 11, 1929, and involved both field and laboratory studies. Eight manufacturers sent their corn planters to Madison

[1]Secretary of the Joint Commttee on Fertilizer Application, and assistant director, soil improvement work, National Fertilizer Association. Assoc. Mem. A.S.A.E.

[2]For full information on the organization, personnel, and purpose of this Committee, see "Reports and Proceedings of the Joint Committee on Fertilizer Application, 1925-1928," published by the National Fertilizer Association, Washington, D. C. (The Joint Committee on Fertilizer Application is comprised of representatives of the National Fertilizer Association, American Society of Agronomy, National Associaton of Farm Equipment Manufacturers, and the American Society of Agricultural Engineers.)

TABLE I. Summary of Field Test on Placement of Fertilizer in the Hill
Judges - A. T. Wiancko, C. O. Rost and E. Truog

Make of Corn Planter	Dimensions of Fertilizer Band			Position of Fertilizer Band in Relation to Seed		
	length	width	depth	ahead	behind	vertically
	in.	in.	in.	in.	in.	in.
A	8	1 1/4	1	6	2	with corn
B	12-16	3/4	1 1/2	8-10	4-6	with corn
C	6- 8	1	1	1- 2	5-6	with corn
D	10-14	3-4	1/8-1/4	6- 9	4-5	½ above
E	8-10	1-2	1	6- 8	2	with corn
F	9	3/4	2	6	3	½ above
G	4- 5	1 1/4	1	Dropped between hills		
H	7- 8	3/4	1 1/2	5- 6	2	with corn

Remarks on distribution by the judges -
Planters A,B,C,E,F and H - Fertilizer in narrow strip right with seed. More spreading and mixing with soil needed.
Planter D - Good distribution and mixing with soil.
Planter G - Fertilizer not dropped in right place.

TABLE II. Minimum and Maximum Rates of Fertilizer Application Possible with Different Planters
(Average of 3 trials, 10 revolutions of wheel, 22.4 hills, planter stationary, hoppers two-thirds full to full)

Make of Planter	Minimum Rate of Application Pounds per Acre		Maximum Rate of Application Pounds per Acre	
	left	right	left	right
A	46	47	359	330
B	28	60	515	536
C	31	24	508	520
D	33	38	361	347
E	33	21	617	594
F	55	53	547	513
G	24	10	601	519
H	52	60	252	262

The maximum and minimum rates will vary somewhat from the above figures with different fertilizers. Recent work by the Bureau of Chemistry and soils in cooperation with the Bureau of Public Roads of the U.S.D.A. shows that the delivery rate of fertilizers is markedly affected by difference in humidity at different periods of the day and, to a greater extent, by the mechanical condition of the fertilizer, size of particles, density, etc.

TABLE IV. Hopper Capacity, Shape, Cleaning, Agitator, Delivery

Make[1]	Shape of Hopper[2]	Capacity of Hopper, lbs.[3]	Provision for Cleaning[4]	Agitator[5]	Delivery Tubes[6]
Case	Conical	49	Hopper detaches by loosening one bolt	Cross arm integral with bottom just above plow feed	Spiral steel ribbon
Hayes	Cylindrical	43	Cleaned from top; cannot be removed easily	Cross arm just above plow feed	Spiral steel ribbon
John Deere	Conical	41	Hopper easily removable from bottom	Single arm 4 in. above bottom	Steel tube
McCormick-Deering	Cylindrical	38	Hopper and bottom easily detachable; bottom can also be separated from hopper	Single arm 4 in. above bottom	Spiral ribbon
Massey-Harris	Conical	46	Cleaned from top; cannot be removed easily	Cross arm just above plow feed	Steel tube
Moline	Conical	42	Hopper and bottom hinged to tilt off	Cross arm just above plow feed	Steel tube
Oliver	Conical	35	Cleaned from top; cannot be removed easily	Two single arms 1 in.& 3 in. above bottom	Spiral ribbon
Superior	Cylindrical	51	Hopper hinged to tilt off bottom	Two single arms 2½ in. & 5 in. above bottom	Spiral ribbon

[1]Listed in alphabetical order.
[2]Cylindrical has straight sides; conical has smaller top than bottom. The latter type is supposed to prevent bridging of fertilizer in the hopper. A large diameter of hopper tends to prevent bridging, but such a hopper will not feed out as low as a small diameter hopper.
[3]Computed on a basis of an average mixed fertilizer weighing 75 pounds per cubic foot. Capacity will vary from figure given according to density of fertilizer. To make one round across a field 80 rods long, planting 3½-foot rows, each hopper must discharge 26½ pounds when fertilizing at the rate of 125 pounds per acre, or 53 pounds when fertilizing at the rate of 250 pounds per acre. Allowance must be made for the fact that hoppers will not discharge their full capacity.
[4]Ease of cleaning is desirable for properly taking care of the fertilizer attachment. If fertilizer is allowed to remain in the hopper, serious corrosion will take place in a few days if the machine is unsheltered. When the machine is sheltered, corrosion is slower, but may be very serious in the course of a few months or a year.
[5]Desirable, to prevent bridging and insure steady feed.
[6]Spiral ribbon tubes are supposed to be less likely to clog. In one of the above makes with spiral ribbon tubes the vibration of the tubes was so excessive as to cause some loss of fertilizer.

TABLE V. Feed, Adjustment, Visibility, Timing, Type of Spreader

Make[1]	Kind of Feed[2]	Adjustment of Feed[3]	Visibility of Feed[4]	Timing of Fertilizer Drop[5]	Type of Spreader[6]
Case	Revolving disk bottom, stationary plow feed	Plow swings in or out on pivot, 9 notches for 9 different rates	From front only	Can be timed separately from corn drop to place fertilizer at any place in the hill or between hills	None
Hayes	Revolving disk bottom, stationary plow feed	Plow swings on pivot, 12 notches for 12 different rates	From front only	Same as corn drop;no adjustment possible	None
John Deere	Revolving bottom, stationary plow feed	Hopper raises off bottom on 3 inclined planes and can be set at any point at or between 12 marks	From front, and from driver's seat by leaning forward	Same as corn drop;cannot be adjusted	Inverted V inside of 3" housing
McCormick-Deering	Revolving bottom, stationary plow	Hopper raises off bottom by two racks and pinions, 9 notches for adjustment	Not visible	Same as corn drop; cannot be adjusted	Tapering Inverted V, ½" to 1½" wide,fixed
Massey-Harris	Revolving disk bottom, stationary plow	Plow swings on pivot and can be set at any point at or between 4 marks	From front only	Same as corn valves;cannot be adjusted	Tapering Inverted V, 3/4 to 1½" wide,fixed
Moline	Revolving disk bottom,stationary plow	Plow swings on pivot and can be set at any point, but no marks	Not visible	Same as corn valves;cannot be adjusted	Inverted V, 1 in.wide, fixed
Oliver	Revolving disk bottom, stationary plow	Plow swings on pivot and can be set at any point, but no marks	From front only	Same as corn valves;cannot be adjusted	Inverted V, 1½ in.wide, fixed
Superior	Finger feed, three different plates	Gate which raises or lowers on scale of 4 marks, giving 12 rates with the 3 plates; gate can be set at any point	From driver's seat	Same as corn valves;cannot be adjusted	Inverted V, 1½ in.wide, fixed

[1]Listed in alphabetical order.
[2]The finger feed is the same as is used in fertilizer grain drills. In the revolving disk bottom type, a plow which swings on a pivot in from the circumference of the hopper, diverts a flow of fertilizer varying in quantity according to the adjustment. In a third type of feed, variations in rate are secured by raising the hopper and plow fixed to it from the revolving bottom.
[3]When the feed is adjusted by notches, the variations in rate are limited to the number of notches, since no adjustment is possible between the notches. In one of the planters the rate at one setting was 87 pounds per acre, and the next notch gave a rate of 256 pounds per acre. In general, adjustments for rate of application must be made by the trial and error method. The marks for calibration are in most cases unnumbered or so indistinct or crude as to render accuracy impossible.
[4]Desirable as means to observe whether fertilizer is feeding.
[5]This refers to timing with reference to the corn drop. In nearly all of the planters the fertilizer and corn valves are tripped at the same instant. In some of the planters, a slight adjustment of placement is possible by varying the height of fertilizer drop.
[6]The purpose of the inverted V is to spread the fertilizer, and to prevent too much contact with the seed. The spreader also delays the dropping of the fertilizer, with the result that the seed and fertilizer are slightly separated, which is desirable.

for this test, and most of them had representatives on hand during the test. The National Association of Farm Equipment Manufacturers and the National Fertilizer Association rendered a material service in promoting interest in the project, and E. R. Jones and F. W. Duffee, of the department of agricultural engineering of the University of Wisconsin, made the facilities of their laboratories available to the Committee. The tests were directed by Prof. Truog and the author.

In the field tests, plantings were made across a field some 80 rods in length, and fertilizer was applied at two different rates. A committee of agronomists examined the placement of fertilizer by carefully removing the soil from many hills after planting.

The laboratory tests involved a test of the capacity of the fertilizer attachments for both maximum and minimum rates, and a test of the uniformity of delivery in the hill. Notes were also made on certain details of design which were considered important from the standpoint of good operation.

The results of the tests are given in the accompanying tables and explanatory notes. Since it was not the intention of the Committee to make the tests competitive, the identity of the planters is concealed, except in Tables IV and V.

The purpose of the test was to call attention to obvious defects in performance or design as affecting proper placement of the fertilizer. The tests could be amplified or improved upon, but for the time being they seem sufficient until greater refinements are made in the construction and operation of fertilizer attachments. Field tests with the different planters under varying soil and moisture conditions, applying fertilizers of several analyses at several rates per acre will probably be made at a later date.

TABLE III. Summary - Uniformity of Fertilizer Delivery in the Hill

Make of Planter		Average Rate Pounds per Acre for 15 Hills	Standard Deviation Pounds per Acre	Coefficient of Variability per cent
A	L	69	17.3	25.1
	R	70	12.6	17.9
	L	189	28.5	15.0
	R	171	21.0	12.2
B	L	73	22.1	30.3
	R	80	13.2	16.2
	L	199	50.8	25.4
	R	193	53.3	27.7
C	L	67	23.8	35.2
	R	65	19.9	30.7
	L	258	28.3	11.0
	R	267	30.0	11.2
D	L	93	18.9	19.3
	R	100	20.7	20.8
	L	214	33.0	15.5
	R	232	31.1	13.4
E	L	137	9.2	6.7
	R	112	10.4	9.3
	L	278	23.7	8.5
	R	352	25.6	7.3
F	L	47	4.6	9.8
	R	49	8.9	18.1
	L	242	29.2	12.0
	R	234	70.0	29.9
G	L	51	6.4	12.6
	R	94	10.9	11.6
	L	370	37.5	10.1
	R	266	25.4	9.5
H	L	99	24.0	24.1
	R	63	12.8	20.5
	L	232	26.4	11.3
	R	250	15.1	6.0

Each planter was tested at two different rates of application, a low rate and a medium rate, "L" meaning left side, and "R" right side of the planter.
Standard Deviation is an index of variability, computed mathematically, which shows the departure of the rates per acre for individual hills from the average rate.
Coefficient of Variability is the percentage which the standard deviation bears to the average rate.

Cultivating Sugar Cane With Tractors

By H. H. Hart[1]

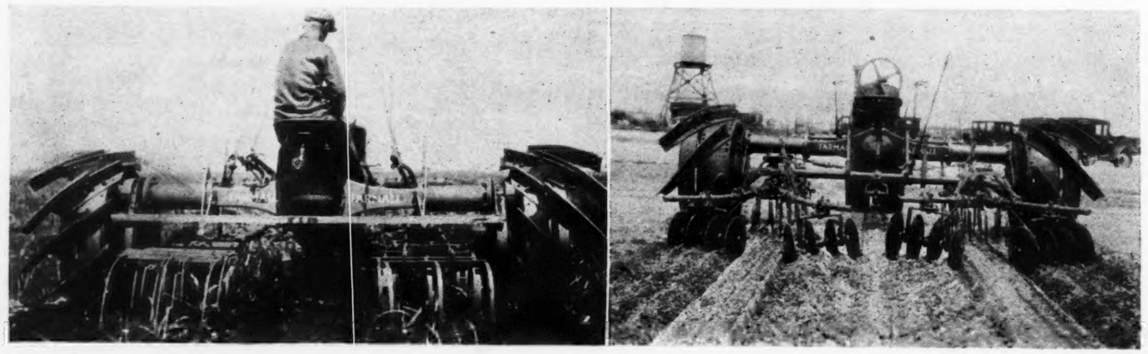
IN ORDER to reduce the labor requirements and cost of production of sugar cane for the Southern Sugar Company of Clewiston, Florida, I have adapted a general-purpose tractor and designed cultivator attachments to meet the required conditions.

To enable the tractor to straddle two six-foot rows of cane the rear axle and housing were extended as shown to space the drivewheels 12 feet on centers. The extension housings were braced and reinforced by a truss rod and a turnbuckle under the differential and by channel iron running to the forward end of the tractor frame. The loose and soft nature of the Everglades soil made necessary the use of large wheel flanges.

Four gangs of four disks per gang are arranged to cultivate between the rows. At the same time two long-tined weeding sections, one directly on each row of cane, take out 90 per cent of the weeds growing in the rows. By mounting the weeder tines far apart on long frames, trouble with collecting trash is minimized. Either of the weeding sections may be lifted vertically out of the soil by means of a lever. The weeding section may be attached under the tractor and the disks in the rear, or vice versa.

This tractor cultivator will cultivate and weed an acre in less than 8 minutes

[1]Southern Sugar Company, Clewiston, Florida.



Two views of the adapted general-purpose tractor with cultivating and weeding attachments. Note the different arrangements of the attachments

A Study of Loss of Rice in Binding

By E. J. Stirniman[1] and C. F. Dunshee[2]

STUDIES of field losses caused by harvesting Calora rice with a self-binder were conducted at the Cortena (Cal.) Rice Station in 1927-28. A self-binder was equipped with pans to collect the loose grain as well as the heads that would be lost from the lower platform, elevating drapers and the binder head. The binder was set to operate with a minimum loss of grain.

Lower Platform. A shallow pan the width of the draper was installed to collect the grain which would fall through between the platform and elevating drapers. The grains collected consisted of short and broken heads with some loose kernels. A large amount of leaf material was deposited in the pan making it necessary to remove the contents eight times during the 0.65 acre test. The total rough rice collected in the 1927 test was 5.8 pounds per acre while 7.4 pounds were secured in 1928.

The grain lost from the front and rear of the lower platform was considered as due to ineffective reel operation. In the 1927 tests the binder reel grain loss was collected by an attendant and placed in the binder head pan. During the 1928 tests two attendants followed the binder picking up all the lost heads which amounted to 8.9 pounds per acre. The kernels in an area of 10 square feet on the ground were counted to determine grain lost by shelling from the reel. The amount was found to be less than 0.1 pound per acre. The combined wind and reel shatter was 0.81 pound per acre.

Lower Elevating Draper. The lower elevating draper grain collecting pan was placed below the seventh roller. It was in a position to receive the grain that would be lost on either side of the roller. The seventh roller was not mechanically operated but left to float. Practically all the grain lost fell through between the draper and roller. The majority of grain lost was pulled through due to straw catching on rough slats or running underneath them. An attendant followed to pick up heads that would fall loose from the draper as it traveled along its lower side. There was very little loss during either test, being only 1.8 pounds per acre in 1927 and 1.1 pounds in 1928.

Self Binding. A large pan was placed in the position of the bundle carrier extending under the deck. An attendant lifted the bundles from the pan as they were discharged from the binding head.

In the 1928 test 74.5 per cent of the total binding grain loss was at the self-binding head, 47.8 per cent of which was loose grain. There was a small loss of grain below the packer arms that could not be collected with the equipment used. A limited number of counts on the ground on which this grain fell indicated less than one-half pound per acre loss. The packers were responsible for the majority of loose grain at the binding head. In order to avoid excess shattering the engine clutch was disengaged while the binder was turned at corners or stopping in the field. The 47.8 per cent covers only the loose grain freed from the bundles. Additional loose grain would fall from the bundle if it was inverted. The 52.2 per cent of the total grain lost that remained in the head was lost by the breaking of heads from the straw while being packed and bundle slippage. The binder operator may minimize the bundle slippage loss by close observation in order to properly adjust the cutting length and the binding position.

Shocking. The grain lost in shocking was studied by handling 100 bundles holding them in a horizontal to vertical position such as ordinarily carried to set. The shocks were of the 8-bundle round type. Most of the grain lost occurred as the bundles were lifted from the stubble. The grain lost from the bundles was caught on a canvas as they were lifted and carried. There was some loss of heads while placing the bundles in the shock which was picked up by hand. Very little loose grain fell from the bundles while they were being placed in the shock. A total of 9.5 pounds were lost per acre as shown in the shocking test. The bundles were of medium size measuring 2.35 feet in circumference at the band. They weighed on an average of 16 pounds each during the first binding in the morning, decreasing to approximately 14½ pounds by 9:00 a. m. The plot on which the test was conducted averaged 837 bundles per acre.

Hauling. In collecting the loss of grain from the shock to the thresher, the bundle racks were equipped with tight bottoms to retain all loose grain. The bundles were pitched on the rack in a vertical position to avoid the loose grain from falling to the ground. During a check of 35 acres an average of 9.6 pounds of grain per acre was collected from the bottom of the bundle racks. The haul for the bundles did not exceed ¼ mile.

Yield. In 1927 the plot yielded 3225 pounds of threshed rough rice having a moisture content of 14.1 per cent. The same plot threshed 3930 pounds in 1928 with a moisture content of 13.6 per cent.

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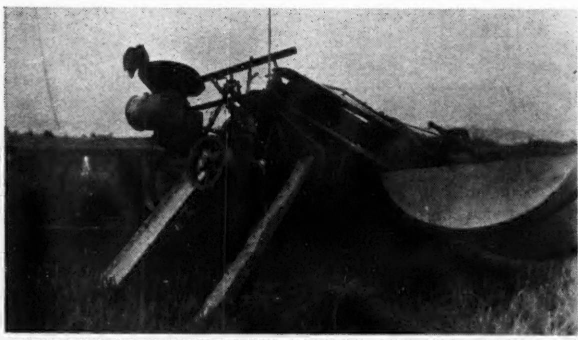


(Left) The grain collecting pans for the platform and elevating drapers at rear of binder previous to installing. The pan for the self-binder is shown installed. (Right) The binder equipped with the grain collecting pans

A field of rice shocks in California

Conclusion. The total loss in binding in 1927 was 73.6 pounds per acre, and in 1928, 72.1 pounds, or an average of 0.22 per cent of the total yield. The conditions under which these tests were conducted would probably show the minimum loss for binding. The grain was not overripe, having a moisture content of from 20.2 to 22.4 per cent when bound, decreasing to 13.6 and 14.1 per cent when threshed 10 days later. An overripe field in which harvesting was delayed by rain, showed a loss in excess of 50 per cent. This loss was not only due to the shattering of overripe grain when bound, but excessive lodging and wind shatter.

Rice Lost in Binding 1928
October 6, Plot No. 16

Area tested	Grain Lost per Acre	
	Place	Pounds
0.65 acres	Binder lower draper	7.4
0.65 acres	Binder upper draper	1.1
0.65 acres	Binder head draper	53.7
0.65 acres	Binder reel draper	8.9
		72.1

Moisture content of bound grain, 20.2 to 22.4 per cent
Moisture content of threshed grain, 13.6 per cent
3930 pounds grain threshed per acre
Pounds rice lost based on moisture content of threshed grain

Rice Loss in Binding, Shocking and Hauling 1927
October 10, Plot No. 16

Area tested	Grain Lost per Acre	
	Place	Pounds
40 sq. ft.	Ground before binding	8.0
0.44 acres	Binder lower draper	5.8
0.44 acres	Binder upper draper	1.8
0.44 acres	Binder head and reel	66.0
35 acres	Loose in bundle wagon	9.6
100 bundles	Shocking	9.5
		100.7

Moisture content of threshed grain, 14.1 per cent
3225 pounds grain threshed per acre

A Vacuum Gage for Pumps

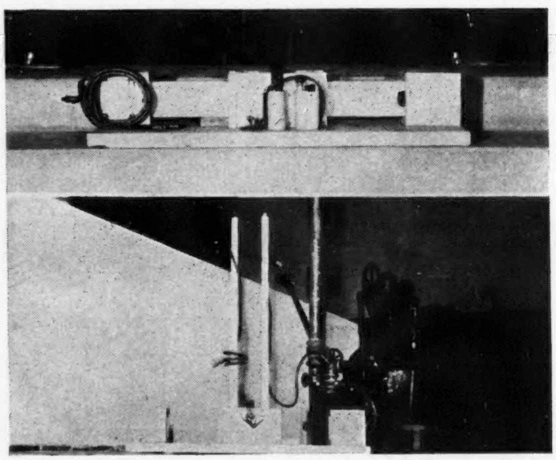
By W. L. Ruden[1]

THE accompanying illustration shows a vacuum gage that does not need to be calibrated. It has no springs or weights to get out of order since a column of mercury registers the suction. This can be measured directly in inches of mercury.

The lower illustration with the upright pieces in place shows one of the gages attached to the suction pipe of a centrifugal pump. The other gage (each upright being a separate unit) is not in use here, but could be connected to another point if desired.

The upper illustration shows the compactness of the unit when packed for carrying. The uprights, placed together so that the mercury tubes are protected, slide into the compartment. When the rubber tubing is wrapped around the hooks, it is out of the way and also protected from kinking. In addition, it is extra heavy to avoid collapsing while in use. Compartments at the side hold the bottles of mercury which can be strapped securely in place.

This gage was designed and constructed by E. J. Stirniman, of the agricultural engineering division, University of California, and the writer. It is used for class instruction and for general pump testing.



Two views of the vacuum gage for pump testing designed by E. J. Stirniman and W. L. Ruden

[1]Associate in farm mechanics, University of California, Jun. A.S.A.E.

Suggestions on the Construction and Operation of Dairy Farm Cooling Plants[1]

By Ben D. Moses[2]

BECAUSE milk, as it it is drawn from the cow, is of a temperature favorable to bacterial growth, and because it is known that this growth can be checked by cooling the milk, regulations have been set up in different states and municipalities for the cooling and storing of milk which is to be used for human consumption. These requirements are different for different sections, but there is general agreement upon the importance of keeping the bacteria count as low as possible. There may be some disagreement as to methods used and even as to what temperatures should be specified, but the cooling of market milk to below 50 degrees (Fahrenheit) seems to meet the general approval of bacteriologists and health authorities.

Acting upon the recommendation of investigators in the quality of milk, many states and municipalities have appointed inspectors whose duty it is to see that dairies are kept in sanitary condition, that approved methods are practiced, and that the product meets certain specified standards.

The dairyman is confronted with the problem of complying with state and municpal regulations, of meeting the demands of his customers, and finally of keeping his business on a paying basis. He has several classes of business from which to make his selection. He may sell cream, manufacturing milk, raw milk in bulk to the dairy companies or in bottles to consumers; or he may even sell pasteurized or certified milk.

It is not the purpose of this paper to discuss mechanical details of refrigerating machinery nor to consider the general problem of refrigeration, but to deal with the specific problem of cooling and storing market milk.

Refrigeration is becoming increasingly important on the dairy farm for cooling and storing milk and its products and for the manufacture of ice. The farmer's problem for cooling and storing milk is largely an economic one, and his selection of equipment is governed to a considerable degree by the effect of its use upon his net returns.

[1]Paper presented at the 23rd annual meeting of the American Society of Agricultural Engineers, at Dallas, Texas, June, 1929.

[2]Associate professor of agricultural engineering, University of California; and associate agricultural engineer, California Agricultural Experiment Station. Mem. A.S.A.E.

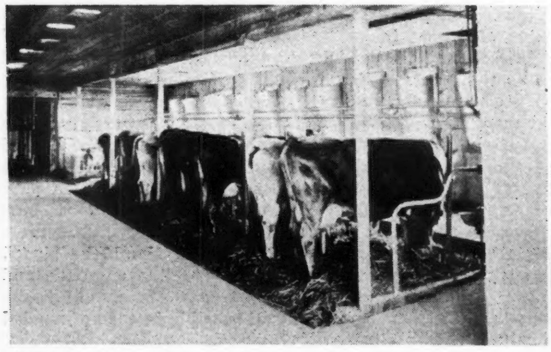
No item should be overlooked and the total cost should include all overhead charges and operating costs. A dairy that is equipped with a ¼-ton refrigeration unit and a cold storage room that demands a one-ton machine to keep it cool, is just as wrong as one equipped with a one-ton refrigeration unit serving equipment that can be handled by a ¼-ton machine. It is easy to overlook increase in milk handled as the business grows, or additions to equipment as the quality or grade of milk is improved, and to underequip. Ignorance on the part of the farmer of what a refrigerating machine can do or of the salesman on the adaptability of his machine to the conditions may result in the installation of either too small or too large a plant or in the poor arrangement of equipment. Incorrect selection or installation will decrease profits either by throttling production or by piling up the overhead or operating costs.

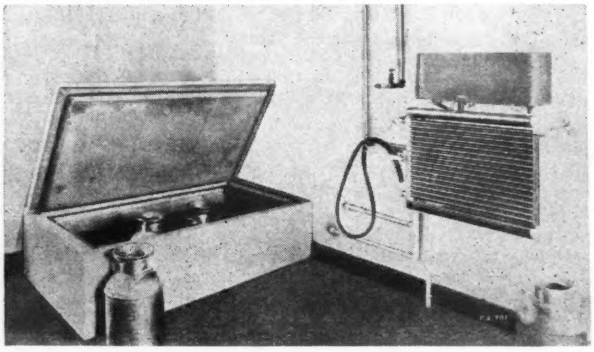
One dairy recently coming under my observation is producing 150 gallons of milk a day and has an investment of over $3,500 in a milk cooling and storing plant sufficiently large to handle 500 gallons of milk. The installation is suited to a large commercial dairy and the boxes would be a credit to a meat market or hotel, but it is not suited to a 50 or 60-cow dairy farm.

Another refrigerating machine was guaranteed to cool 200 gallons of milk a day but when installed had to run continuously in order to cool 130 gallons. It was also found that this company had installed the same size machine on five different dairies varying in production from 70 to 250 gallons a day. It seems quite obvious that a plant capable of handling satisfactorily 250 gallons a day would be too large for a dairy producing 70 gallons, and vice versa; a plant suited to a 70-gallon dairy could not satisfactorily cool 250 gallons.

From the results of studies made of surveys and tests, as well as from statements made by the farmers themselves, it would seem that the dairy cooling plant is a splendid example of the principle that selection of proper refrigerating equipment is a prerequisite to efficient operation.

When a dairyman is in the market to purchase cooling and refrigerating equipment, he should be able to supply the following information:





The pipe lines for the mechanical milker, in the stable at the left, are directly over the stanchions. Milk from the milking machine is taken directly to the cooling room, shown at the right, where it is poured into the aerator. Water from the cooling tank, which is insulated with corkboard and cooled by electric refrigeration, is pumped through the lower half of the aerator, and well water cools the upper half. This process cools the milk immediately from 95 to 42 degrees

1. How much milk will the refrigerating plant be called
2. To what temperature will the milk be cooled?
3. What cooling methods will be used?
4. How much milk will be stored each day?
5. What is the storage temperature required?
6. What kind of storage box will be used?

upon to cool a day?

7. What is the probable milk room temperature?
8. What is the temperature of the cooling water?
9. How much ice is to be manufactured?

With this information in hand, each salesman should be able to recommend the model and size of his machine best suited to the job.

The superiority of one refrigerant over another, of certain mechanical features, and special arrangement of parts, are all technical points that must be judged on their respective merits. The price, appearance and workmanship as well as the manufacturer's reputation for maintaining service, are factors that should influence the farmer in making his selection. The most important question to definitely settle, however, is that of size. How big must the brine tank be, and how large the compressor? If either is too large or too small, operating costs will be high. The average power consumed and the time the compressor runs are good indicators of their performance. The compressor should run about 15 hours a day and the power consumption should be not over 0.2 kilowatt hour for each gallon of milk cooled a day to 35 or 40 degrees.

There are two systems for storing milk in general use, the "wet" and the "dry." In the one the containers are filled with milk and placed in a tank of cold water or brine, while in the other they are placed in the cold air in a cold storage box or room.

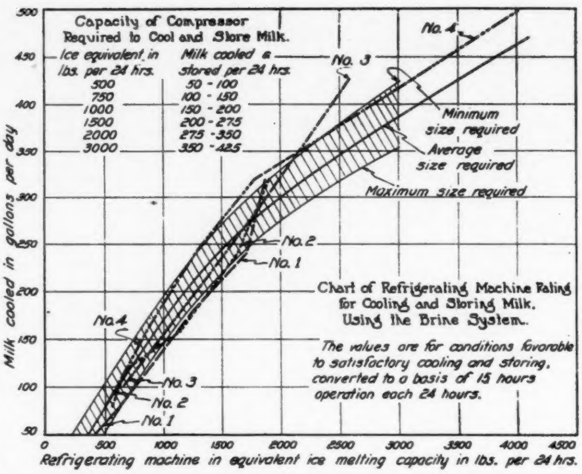
The wet system is also used for cooling milk in which case the milk can can be placed in the tank soon after being drawn from the cow at a temperature of about 90 degrees, or it can first be passed over an aerator and precooled to any temperature desired, by circulating either well water, brine, or both through the aerator. The wet system is best adapted to the smaller dairies upon which quick cooling is not a requirement; the principal advantages are:

1. The first cost is low
2. The tank is easy to build and install
3. There is a constant supply of cold brine; it stores refrigeration
4. It is a simple matter to manufacture small quantities of ice.

The chief disadvantages of the "wet" system are:

1. It is limited in its use to cans
2. It has no dry storage space
3. It is inclined to be mussy and unsanitary
4. The cans have to be lifted into and out of the brine. (Side openings are not possible.)
5. The brine must be kept cold continuously, whether the tank is being used or not
6. Cooling is slow unless an aerator is used.

In the dry system the milk is cooled on an aerator and then either shipped or placed in a dry cold storage box. The aerator can be cooled by passing water through the upper tubes and brine through the lower, brine through all the tubes, or by using the tubes or part of them as the evaporator of a direct expansion system. Approximately six inches in length of tubular aerator for each ten gallons of milk per hour has been found to be good practice. Where water is available for circulating through the aerator the refrigerating machine can be relieved of considerable of its cooling load. A flow of approximately one gallon of water per minute will satisfactorily lower the temperature of ten gallons of milk per hour. The flow of the brine or the expansion valve adjustment on the aerator must be so regulated as to cool the milk to approximately forty degrees without freezing it on any of the cooler surfaces. The brine for cooling the aerator should be circulated with a centrifugal type pump so that the quantity can be varied by throttling the discharge or suction. The running parts should be of brass or some metal resisting the corrosive effect of the brine. A ¾-inch pump driven by a ¼-hp. electric motor will handle any quantity of milk up to 400 gallons a day.



Where milk is cooled by the brine system and not stored, it will require between 5 and 6 pounds of refrigeration capacity (in terms of melting ice) for each gallon of milk cooled a day, and 7 to 9 pounds with the direct expansion system. If the milk is to be stored, this demand will be increased from 8 to 12 per cent. A study of the performances of five dairies in California producing from 70 to 180 gallons a day gave an average of 10 per cent for the difference between the demand on the refrigerator when the milk was cooled only and when it was cooled and stored.

A 20 to 25 per cent solution, by weight, of sodium chloride, or a 15 to 20 per cent solution of calcium chloride will produce a brine with a freezing point lower than 10 degrees.

If the brine tank is used without a cold storage box, it should be covered with a material having insulation value equivalent to that of 3 or 4 inches of sheet cork.

Too small a quantity of brine will result in insufficient storage of refrigeration and consequent poor cooling of the milk; too large a quantity will occupy unnecessary space and increase heat losses as well as construction costs. A weak solution may result in freezing of the brine or of unsatisfactory cooling.

If the walk-in type of box is used it should be so designed as to have a minimum of waste space; should be insulated on all sides with material having the equivalent value of 3 or 4 inches of sheet cork; should be provided with a well-made, tight-fitting door and have a floor sloped so as to facilitate cleaning. The greatest of care should be used to waterproof all surfaces and joints and protect the insulation against moisture. Frosting in the cracks is harmful to the wall material. The floor space should be ample to store all the containers to be placed in the box at one time. Cans and crates vary a little in size, but a 15x15-inch allowance for cans and an 18x20-inch allowance for crates of bottled milk will be found to meet the usual requirement. The brine tank should be placed in such a position as to produce convection currents, and yet not render valuable space useless. It should be so supported as to make its removal possible in case of needed repairs.

The chief difference between the walk-in and nonwalk-in boxes is in their size. The construction is similar, with the possible exception of the floor. The nonwalk-in type is easily made portable and can be manufactured and sold

as a unit. Several of the refrigerator manufacturers now have milk-cooling cabinets for sale.

The advantages of the dry system are:

1. Cooling is quick
2. Dry cold storage is easily provided
3. Cans or crates are easily handled
4. It stores refrigeration, if the brine system is used
5. It can be used for any size or type of container.

The disadvantages of the dry system are:

1. The first cost is high
2. The brine must be kept cold continuously whether the tank is used or not
3. It occupies more space.

The advantages of the brine system are:

1. Smaller compressor
2. Refrigeration can be stored in the brine tank
3. It keeps a fairly uniform box temperature.

The disadvantages of the brine system are:

1. More equipment is necessary. (Brine tank and pump and sometimes brine pump motor.)
2. It requires three heat transfers (milk to brine, brine to refrigerant, and refrigerant to compressor cooling medium.)
3. Extra care necessary for cleanliness.

The advantages of the direct-expansion system are:

1. Less equipment
2. Only two heat transfers. (Milk to refrigerant and refrigerant to compressor cooling medium.)
3. Usually cleaner.

The disadvantages of the direct expansion system are:

1. Larger compressor
2. Cannot store refrigeration
3. Does not keep a uniform storage box temperature.

Satisfactory operation of milk cooling plants depends more upon the correct selection of the refrigerating machine than of any of the other units. They are rated on their ability to replace ice and at the present time are made in ⅛, ¼, ⅜, ½, ¾, 1, 1½ and 2-ton sizes. It must be remembered that refrigeration will have to be available throughout the warmer part of the year but that the load will vary depending mainly upon the air temperature, the cooling water temperature, the quantity of milk produced, and the condition of the insulation used on the box and pipes. The following table gives the range of machine sizes for different quantities of milk produced:

Capacity of Compressor Required for a Given Quantity of Milk Cooled per Day Using a Brine System*

Capacity of Compressor in Tons and in Pounds of Ice per 24 Hours		Gallons of Milk to be Cooled per Day
tons	pounds	
¼	500	50-100
⅜	750	100-150
½	1000	150-200
¾	1500	200-275
1	2000	275-350
1½	3000	350-400

*For direct expansion systems, the capacity of the compressor should be increased approximately 50 per cent for cooling the same quantities of milk.

These values have been plotted in the accompanying graph, and the shaded area represents the range of ratings for brine systems to cool and store different quantities of milk using a two-way type of aerator. The solid line through the center of the shaded area represents the average. That these values are found to be practical is shown by the lines plotted for four different makes of machines. If the direct expansion system is used, the size should be increased about 50 per cent, because there is no available brine to assist in the cooling. In order to provide for expansion and to take care of conditions as they might obtain during a hot spell, the machine should not operate over 15 hours during the hottest weather.

Summarizing the points brought out, we have:

1. Selection of proper refrigerating equipment is a prerequisite to efficient operation.
2. The dairyman must comply with state and city regulations.
3. The dairyman should understand his own cooling problem and be guided in his purchase by efficiency of equipment, cost of operation, and dependability of service from the dealer.
4. In the selection of equipment, provision should be made for reasonable expansion in business but care must be exercised not to overequip.
5. The walk-in type of storage box possesses the conveniences of a room over the nonwalk-in box.
6. Cans are submerged in water or brine, in the wet system, and either cans, bottles or crates are placed in the air of a cold storage box or room, in the dry system.
7. The brine system requires 5 to 6 pounds of refrigeration each 24 hours for each gallon of milk cooled and the direct-expansion system requires 7 to 9 pounds.
8. Each unit of the plant should correspond in size with each other unit.

The following is a table of useful information:

Specific heat of milk	0.9
Cold storage temperature of milk	35 degrees (Fahrenheit)
Weight of milk per gallon	8.6 pounds
Heat removed in cooling one gallon of milk 1 deg. F.	7.74 B.t.u.
Milk temperature as it comes from the cow	98 degrees (Fahrenheit)
Length of aerator per 10 gallons of milk per hour	6 inches
Water required for aerator	1 gallon per minute for each 10 gallons of milk per hour
Approximate capacity of refrigerator in equivalent ice for each gallon of milk cooled and stored a day using the brine system	5 to 6 pounds
Approximate capacity of refrigerator in equivalent ice for each gallon of milk cooled and stored a day using the direct-expansion system	7 to 9 pounds
Ratio of quantity of brine to quantity of milk cooled a day	1.5 to 1
Strength of brine—NaCl	20 to 25 per cent
CaCl	15 to 20 per cent
Insulation for storage box or brine tank-equivalent of sheet cork	3 to 4 inches
Floor space in cold storage room per can	15 by 15 inches
Floor space in cold storage room per stack of crates	18 by 20 inches
Desirable operating time of refrigerating machine	15 hours
Approximate energy used per gallon of milk cooled and stored a day	0.1 to 0.2 kw-hr.

Studies of the Septic Tank Method of Sewage Disposal for Isololated Homes

By H. B. Walker[1] and R. H. Driftmier[2]

Absorption System. The underground absorption system for final disposal of the effluent was used for both systems. Each tank was equipped with an automatic siphon, since it was believed that an intermittent application of the sewage is essential in order that resting periods may be provided for the soil to recover its oxidizing capacity. The process of purification of the effluent in an underground absorption system is similar to that of contact beds or sand filters. The organic matter is oxidized and the water is removed by percolation, transpiration and evaporation. For successful operation the preliminary treatment of the sewage should be such as to reduce to a minimum the suspended solids. Fig. 14 shows typical tile removed from the Poultry Farm absorption system 21 months after installation. The chemical analysis of the tile accumulations is given in Table II. From these data it is estimated that 80 to 90 per cent of the material composing the deposit in the tile A2, A3, B2, B3, is made up of soil that has worked into the tile through the open joints. The deposits in A1, C1, and C2 are composed largely of sewage residue. B1 and C3 have considerable soil in their make-up; however, not nearly as much soil as samples showing the smaller nitrogen content. It is evident then that great care should be taken to protect the tile joints. Such a precaution would prevent the tile from becoming clogged and would also be a safeguard against possible settlement and displacement.

No complete studies relating to the efficiency of the absorption system as a means of oxidizing the tank effluents have been completed.

[1]Professor of agricultural engineering, University of California. Mem. A.S.A.E.

[2]Professor of agricultural engineering, Kansas State Agricultural College. Mem. A.S.A.E.

TABLE II. Chemical Analysis of Deposits in Absorption Tile Poultry Farm Installation

Tile	Ash	Nitrogen
A1	69.69	2.22
A2	93.55	0.234
A3	93,28	0.230
B1	85.28	0.943
B2	93.83	0.304
B3	94.27	0.204
C1	61.12	3.160
C2	71.27	2.080
C3	90.79	0.530
*Evaporated sewage from dosing chamber	61.62	1.090

*Total solids 1450 P.P.M.

TABLE III. MONTHLY AVERAGES OF SEWAGE ANALYSES
-Parts per Million-

Month	Dissolved Solids: Agronomy Farm S.C.1	S.C.2	D.C.	Dissolved Solids: Poultry Farm S.C.	D.C.	Suspended Solids: Agronomy Farm S.C.1	S.C.2	D.C.	Suspended Solids: Poultry Farm S.C.	D.C.	Total Solids: Agronomy Farm S.C.1	S.C.2	D.C.	Total Solids: Poultry Farm S.C.	D.C.
May 1927	970	1068	989	1253	1210	518	538	436	3392	269	1488	1606	1425	4645	1479
June	1167	1317	1215	1075	1040	122	565	1025	2820	165	1289	1882	2240	3895	1205
July				1091	1068				177	135				1268	1203
Aug	987	1795	959	1478	1161	1670	4366	487	2249	108	2657	6161	1446	3727	1269
Sep	1108	1033	955	1509	1211	619	419	362	1574	60	1727	1452	1317	3083	1271
Oct	925	928	930	1065	1028	[illegible]	811	301	747	127	1355	1739	1231	1812	1155
Nov	1001	988	937	1054	1017	715	455	145	553	52	1716	1443	1082	1607	1069
Dec	1013	924	1033	942	883	740	431	131	337	75	1753	1355	1164	1279	958
Jan 1928	880	875	955	1120	1143	335	235	145	232	67	1215	1100	1100	1352	1212
Feb	778	809	912	972	957	969	307	111	1106	117	1747	1116	1023	2078	1074
Mar.	1111	1033	1083	1111	1127	1764	612	98	676	[illegible]	2875	1646	1181	1787	1159
Average	994.0	1072.0	996.8	1156.8	1072.0	788.4	873.9	324.1	1260.2	111.9	1782.4	1980.9	1320.9	2412.0	1188.9

S.C.1 = First Settling Chamber S.C.2 = Second Settling Chamber D.C. = Dosing Chamber

Chemical Analysis. The results of the chemical analysis covering suspended and dissolved solids are shown for the Poultry Farm system by Fig. 12. These studies cover a one-year period from March 9, 1927, to March 19 1928. An important fact to be noted from these data, from the standpoint of a farm sewage disposal system employing a subsurface irrigation system for final disposal of the effluent, is the reduction in suspended solids which is due in a large measure to the type of baffle used. In the septic chamber 59.8 per cent of the total solids were dissolved solids and 40.2 per cent suspended solids; whereas in the siphon chamber (after the sewage had passed the baffles) 88.5 per cent of the total solids were dissolved solids and only 11.5 per cent were suspended solids. For successful operation of a subsurface absorption system as a means of caring for the effluent, the preliminary treatment of the sewage should be such as to reduce to a minimum the suspended solids contained in the sewage.

Comparative results for the Poultry Farm septic tank when equipped with the baffles shown in Fig. 4, and the Agronomy Farm septic tank when equipped with the two compartment baffling system, Fig. 3, are given in Tables III and IV. These data cover the eleven-month period from May 1927 to March 1928. They indicate that a single chamber, efficiently baffled, will cause a greater reduction in solids than will a two-compartment settling chamber. The Poultry Farm tank with the single septic chamber showed a reduction in suspended solids from 1260.2 parts per million to 111.9 as an average for the period, whereas the Agronomy Farm tank with two compartments only gave a reduction of from 788.4 parts per million to 324.1.

Bacterial Analysis[3]. The bacterial analysis of twenty-three samples of sewage is shown in Table V.

The total counts were made by plating on standard agar and incubating at 37 degrees (Centigrade). The colon counts for the first part of the work were made on modified eosinmethylene blue agar in comparison with the dilution method in lactose fermentation tubes. The dilution method alone was used for the last part of the work. The highest dilution showing gas was taken to indicate the approximate number of colon bacilli present.

As is to be expected, there is great variation in the determinations from time to time. These variations are due to the differences in rate of flow and to errors in bacteriological technic. As is well known, there is great diurnal variation in the bacterial content of sewage because of the great variation in intestinal material. By considering the averages of all these determinations we find that there was a decrease of 18.9 per cent in the total count, and a decrease of 32.6 per cent in the total colon count between the septic tank and the dosing chamber. The septic effluent, as applied to the absorption sys-

[3]Interpretation of Bacterial Analysis by Dr. L. D. Bushnell, professor and head of department of bacteriology, bacteriologist, Agricultural Experiment Station, K.S.A.C.

Fig. 14. Typical tile removed from Poultry Farm absorption system 21 months after installation

TABLE V. BACTERIAL ANALYSIS OF THE POULTRY FARM SEPTIC TANK
November 12, 1926, to March 19, 1928

Date	Total Bacteria per cc.		Total Colon per cc.	
	Dosing chamber	Septic chamber	Dosing chamber	Septic chamber
Nov. 12, 1926	4,400,000	2,850,000	3,600,000	2,450,000
Mar. 9, 1927	850,000	3,100,000	600,000	700,000
15, 1927	14,033,000	10,700,000	2,025,000	10,700,000
22, 1927	2,250,000	1,800,000	1,050,000	1,512,500
29, 1927	1,900,000	3,800,000	1,300,000	2,375,000
Apr. 5, 1927	4,000,000	19,400,000	3,650,000	18,884,000
13, 1927	4,400,000	2,850,000	3,600,000	2,450,000
20, 1927	100,000	500,000	20,000	350,000
Sept. 28, 1927	10,000,000	2,450,000	1,000,000	10,000
Oct. 4, 1927	18,000,000	30,000,000	100,000	50,000
10, 1927	8,200,000	24,700,000	10,000.000	100,000
17, 1927	16,200,000	9,800,000	500,000	100,000
24, 1927	5,100,000	10,300,000	10,000,000	750,000
25, 1927	8,700,000	4,100,000	100,000	500,000
Nov. 14, 1927	16,000,000	12,000,000	100,000	500,000
21, 1927	7,000,000	3,000,000	10,000	50,000
28, 1927	9,000,000	11,000,000	1,000,000	750,000
Dec. 5, 1927	19,000,000	32,000,000	100,000	50,000
12, 1927	20,000,000	15,400,000	500,000	500,000
19, 1927	2,200,000	15,600,000	100,000	100,000
Jan. 23, 1928	4,200,000	12,450,000	50,000	10,000
Feb. 20, 1928	21,000,000	13,000,000	400,000	400,000
Mar. 19, 1928	28,000,000	34,000,000	10,000	1,000,000
Average	9,770,000	11,926,000	1,296,000	1,926,000

TABLE IV. CHEMICAL ANALYSIS (PARTS PER MILLION)

Date	Ammonical Nitrogen					Chlorine				
	Agronomy Farm			Poultry Farm		Agronomy Farm			Poultry Farm	
	SC1	SC2	DC	SC	DC	SC1	SC2	DC	SC	DC
4-19-27 4-26-27	134	114	150	258	100	240	240	216	216	240
5-28-27	127	120	110	194	89	197	234	215	222	269
7-15-27				94.7	95.5				117	115
8-18-27	177	214	110	213	94	99.3	92.2	92.2	124.1	141.8
9-26-27	131	153	165	109	142	127.6	141.8	127.6	141.8	141.8
10-28-27	182	183	149	153	126	158	175	198	162	209
12- 9-27	190	182	164	128	113	127.6	127.6	127.6	141.8	127.6
1-31-28	159	159	162	133	101	158	158	141.8	158	141.8
2-21-28	148	132	147	153	90	81.4	81.4	117	148.9	113.5
3-19-28	269	195	167	142	100	179.1	166.6	191.5	129.4	124.1
Average	168.5	161.3	147.1	157.7	105.1	152.0	157.4	158.5	156.1	162.4

SC1, first settling chamber
SC2, second settling chamber
DC, dosing chamber

tem, was still very high in bacteria. Of course, the effectiveness of a sewage disposal system depends largely upon the oxidizing processes which take place in the soil. This phase of the process could not be tested.

The variation in bacterial counts is so great as to make comparisons of individual determinations of little value as an indication of the effectiveness of the system at any particular time. Bacteriological tests, on account of their excessive delicacy, are of less value than chemical determinations in the presence of gross polution as found in septic tanks. No tests were made over the period of the years when the surface scum was decreasing in thickness, but the process was so gradual that the slight increase in bacterial activity would probably not have been evident in the determinations.

SUMMARY

1. The use of the two-chamber septic tank for the treatment of sewage from farm homes is effective when properly designed, in preventing a nuisance.

2. The volume of sewage flow as determined by these studies varied from 9 to 35 gallons per person per day.

3. Twenty gallons per person per day appears to be a reasonable allowance in considering volumes of sewage for farm home septic tank design.

4. Sewage flow from the farm home is greatest during the summer months and least during periods of lowest temperature.

5. Monday and Saturday are the peak days for farm home sewage flow.

6. Scum formations tend to increase in thickness with prolonged rises in temperature and tend to decrease with corresponding decreases in temperature.

7. The trend of the temperature of the tank liquors follows atmospheric temperature trends, but these are relatively higher in wintter and lower in summer than the atmospheric temperatures.

8. The maximum and minimum observed temperatures of the tank liquors during these studies were 73 degrees (Fahrenheit) (max.) and 48 degrees (min.). The mean liquor temperature was 58.9 degrees.

9. Eighty-eight and five-tenths per cent of the total solids entering the siphon chamber were dissolved and 11.5 per cent remained as suspended solids.

10. A retention period of less than 60 hours tends to increase the percentage of suspended solids in the effluent.

11. A retention period of 60 to 72 hours for the sewage in the septic chamber would seem to represent good design for farm installations.

12. The bacterial analyses conducted in these studies indicated an average decrease of 18.9 per cent in the total bacteria count and an average decrease of 32.6 per cent in the total colon count.

13. Subirrigation systems receiving sewage in doses from siphons must have the tile joints protected with tar paper or some other equally effective means to prevent infiltration of soil through the joint openings.

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A CORRECTION

ERRORS in the publication of the installment of this article which appeared in the August issue are corrected as follows.

In the last paragraph of page 257 the grades stater should be changed so that the second and third sentences will read, "This tile was laid with cemented joints at a 2.25 per cent grade. A line of 4-inch vitrified clay sewer tile laid at a 2.5 per cent grade connects the tank to the absorption system."

Further on in the same paragraph (page 258) the sentence referring to the grade at which the tile lines were laid should read "All lines are laid at the grades shown in Fig. 5."

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EDITOR'S NOTE: This is the last of three installments of this paper.

Waste Heat from Power Stations for Hothouse

By J. F. Max Patitz[1]

IN 1925, I visited, in Duesseldorf, Germany, the "Waermestelle," which is a bureau for studying the best means of utilizing heat, especially waste heat. The reason for my visit there was to find out whether any experiments had been made or were contemplated in Germany to use the waste heat from power stations in hothouses. For some time I had been thinking of the possibilities of combining power plants with hothouses, that is, of operating steam or gas engines for generating electricity and of utilizing the waste heat from them in hothouses.

At the time I visited the "Waermestelle" I was told that no experiments had been made or were being made in combining power stations and hothouses. In the V.D.I. Nachrichten of May 22, 1929, were published the two articles under the general heading: "Power Stations in the Service of Feeding People." The following is an abstracted translation of these two articles, entitled "The Hothouse Plant of the Large Power Station Klingenberg" and "Furnace Gas for Carbonic Acid Fertilization."

The Hothouse Plant of the Large Power Station Klingenberg

As hothouses of large size have been very successfully connected with central power stations, for instance, with power station Wiesmoor of the North German Power Stations A-G, or with power station Bleicherode of the Central Power Station Suedharz, G.m.b.H., the Berlin Municipal Electric Works A-G erected in the winter months of 1928-29 near the large power station Klingenberg hothouses for cucumbers and tomatoes, to which is connected as a subdivision a hothouse for flowers. The hothouses erected now cover an area of 107,600 sq. ft., the total area at disposal allows of an extension of 50,380 square feet.

For the heating of the hothouses steam is taken from the power house turbines at 49.7 pounds absolute pressure and is led through counter-current apparatus in which it heats the water of a warm water-pump heating plant. In order to keep up the temperature in the cucumber and tomato houses, when the outside temperature is 4 degrees below zero (Fahrenheit) for a covered area of 157,980 square feet, about 9 tons of steam are required per hour. The tending of the plant is very simple, contrary to the common hothouse plant in which the boilers must be continually tended to, as the steam needed is always available. This continual preparedness is specially advantageous in the transitional periods or on cold summer days, when the temperature drops suddenly and only occasional heating is needed. Especially to be mentioned is the heating of the soil in the cucumber houses besides the heating of the rooms, which secures also in the winter months a favorable temperature of the soil for the growth of cucumbers.

Experiments with electric lighting of the growing plants also have met with great success. If experiments with electric heating of the soil are added, the consumption of current in the hothouses will rise to quite an extent. As this increase in current is mainly used at night, the load factor of the power house will be increased.

Furnace Gas for Carbonic Acid Fertilization

For a number of years, originally by a small circle of scientists, the feeding of plants by carbonic acid has been eagerly studied; quite surprising and significant results have been obtained. That plants are built up mainly of carbon has been well known for a long time. The dry substance contains 19 per cent carbon, while only one to three per cent of minerals including nitrogen are contained in it. It has been believed that the carbonic acid content in air of 0.03 per cent is sufficient for the nutrition of plants. But experiments in hothouses, and also outside, always show that, by artificially supplying carbonic acid, the plants grow faster, blossom earlier and fuller and bear more fruit.

By carbonic acid fertilization the fertilizers used at present are by no means done away with; in fact, their applications on the contrary must be increased. It is self-evident that for economic reasons only cheap carbonic acid gases can be used. According to the process of Dr. Ing. Riedel, of Essen, gases of combustion are used which have been freed of substances deleterious to plants, particularly of sulphurous acid. This process is being introduced more and more in horticulture and in agriculture.

The Northwest German Power Station at Wiesmoor has today about 270,000 square feet of glass covered surface. The hothouses are supplied with steam of the power station which another step in the combining of the power station with is erected on a peat soil foundation. Wiesmoor has taken hothouses by supplying its hothouses from the power house with carbonic acid gas by means of purified gases of combustion. These gases, which have done their duty in regard to giving off heat under the boiler and after passing through air pre-heater and feed water heater and up to now went off through the chimney, are now sucked from the chimney through a gas purifying plant and by means of a ventilator and an underground pipe line transmitted to the hothouse plant which is about 1000 feet distant. There they are evenly distributed by pipes 350 feet long which have equidistant openings. It is sufficient, if the plants are supplied with carbonic acid for one hour each in the forenoon and afternoon. In the beginning of March of this year the plant was started. The growth of the gassed plants is excellent and a great deal better than that in an equally large ungassed house.

[1]Chief consulting engineer, Allis-Chalmers Mfg. Co. Mem. A.S.A.E.

Agricultural Engineering Digest

A review of current literature on agricultural engineering by R. W Trullinger, specialist in agricultural engineering, Office of Experiment Stations, U. S. Department of Agriculture. Requests for copies of publications abstracted should be addressed direct to the publisher.

The Strength of Reinforced and Unreinforced Butter and Cheese Boxes, G. H. Rochester (Canada Department of Interior, Forest Service (Ottawa) Circular 24 (1929), pp. 8, figs. 6).—The results are reported of two investigations on the comparative serviceability of butter and cheese boxes of different types of construction, reinforced and unreinforced, for export shipments. The various types of boxes were submitted to tests in a hazard machine consisting of a revolving drum, 17 feet in diameter, with interior floors arranged in hexagonal form. As the drum slowly revolves, the box is dropped from floor to floor, and guides are so arranged as to cause it to fall successively on corners, edges, and sides, simulating in a comparatively short time the various stresses encountered in actual transportation.

The results indicated that of the forty-six boxes of three types tested the Ontario box of dovetail is the strongest of the types without reinforcements. The box with two parallel straps 0.5 inches by 0.018 inches, and the one with two parallel wires, 13-gage, are respectively, 5 and 3 times as strong as those without reinforcement.

The lighter strappings ⅝ by 0.015 inches when applied two parallel or two at right angles does not give as strong reinforcement as the 13-gage wire similarly applied, but still gives double the strength of the unreinforced box. The two parallel wires or two wires at right angles apparently impart reinforcement of equal value, as far as first failure is concerned, but, under continued abuse, wiring at right angles holds the box together better than parallel wiring. The same is true for strapping.

One strap or wire applied around the center of the box gives nearly double the strength of the unreinforced container. The use of reinforcement of one wire, 13-gage, or one strap, preferably 0.5 by 0.018 inches, applied around the center of the box over sides, top, and bottom should prove sufficient to increase the serviceability of any of the three types of butter boxes tested.

The results indicated that of the 112 cheese boxes tested, unreinforced standard Canadian cylindrical cheese boxes are not of sufficient strength to protect their contents adequately when subjected to severe handling. This is for the most part due to the failure of fastenings to hold the cover securely to the box and the headings to the bands.

Reinforcement by one 13-gage annealed wire increases the serviceability of the cheese box 5 times; one ⅝ by 0.018 inch unannealed strap, 4 times; two 13-gage annealed wires at right angles and two ⅝ by 0.015 inch unannealed straps at right angles, 7 times that of the unreinforced box One wire apparently strengthens the box somewhat better than one strap. This is explained by the fact that the wire when tightened cuts into the edges of the box and retains its position when subjected to rough handling. The strap, on the other hand, has a tendency to slip and so lose some of its effect in holding together the various parts of the box.

The reinforcements of two wires or two straps does not give the box double the strength of the single reinforcement. Either one 13-gage annealed wire or one ⅝ by 0.018 inch unannealed strap applied around the cheese box at right angles to the direction of the pieces in the headings will give sufficient reinforcement to insure a minimum of breakage on export shipments.

The body hoop is of sufficient strength, as practically no failures occurred in that section of the box. In all the top and bottom headings and band failures the heads of the nails have invariably pulled through the veneer. The use of nails with larger heads might prevent a considerable percentage of failures of this type.

The cover of the box should be so placed that the overlaps of the body hoops and the bands may be held by a single reinforcement. Boxes constructed so that the overlaps of the bands and hoops can be nailed into the edge grain of the headings are stronger than those where the overlap is nailed into the end grain. Where single reinforcement is used with the above type of box the cover should be fitted so that the pieces in the top and bottom headings run in parallel directions and the overlaps of bands and body hoops are in line. Single reinforcement should then be placed at right angles to the direction of the heading pieces, and across the overlaps.

Suitability of Little-Used Species of Wood for Shipping Containers, T. A. Carlson (American Lumberman (Chicago), No. 2810 (1929), pp. 38-40, figs. 4).—Tests conducted by the U.S.D.A. Forest Products Laboratory with different species of wood for use in shipping containers under different conditions are reported.

The results showed that green boxes lost five-sixths of their resistance to rough handling after drying for about six days under conditions similar to moderately dry, heated warehouse. The boxes made of air-dry lumber and stored for about 60 days under conditions which caused but little change in moisture content retained 84 per cent of their resistance to rough handling. Air-dry boxes stored for the same length of time under the conditions of an extremely dry, heated room lost more than 9 per cent moisture and retained only 35 per cent of their original strength. Similarly treated boxes, however, when again put in moderate storage regained strength until at the original moisture content they withstood 75 per cent of the rough handling of freshly nailed boxes. The indication are that boxes made of green lumber and allowed to dry will show only about one-quarter to one-half as much resistance to rough handling as boxes made of dry lumber and stored under the same conditions.

On the basis of the relative number of drops which the boxes withstood in the drum test, lodgepole pine, western yellow pine and aspen could be grouped as giving the best results. Next in order would come California red fir, then western larch, and finally a group consisting of white fir, silver fir, western hemlock and lowland white fir.

It was also found that a general classification of the failures in the boxes made from different species of lumber could be made which corresponded with that based on the relative resistance to tumbling in the drum.

Tests of boxes nailed with barbed nails were slightly in favor of the use of barbed nails in boxes made of dry wood and stored. The chief advantage of the barbed over the plain nail was found in the boxes made of relatively green lumber and stored under conditions favorable to drying.

Public Roads, [March, 1929] (U. S. Department of Agriculture, Public Roads, 10 (1929), No. 1, pp. 1-20 + [2], figs. 25).—This number of this periodical contains the status of Federal-aid road construction as of February 28, 1929, together with the following articles: Highway Traffic Analysis Methods and Results, by L. E Peabody (pp. 1-10); and The Effect of Increased Speed of Vehicles on the Design of Highways, by A. G. Bruce (p. 11-20).

Agricultural Engineering, B. J. Owen (In Agricultural Research in 1927. London: Royal Agricultural Society, England, 1928, pp. 77-115).—A review of outstanding progress in agricultural engineering during 1927 is presented from the British viewpoint.

Absorption of Wood Preservatives, J. D. MacLean (Engineering News-Record (New York) 102 (1929), No. 5, pp. 176-179, figs. 1).—This is an abstract of a paper presented at the convention of the American Wood Preservers' Association at Louisville, Ky, January 22-24, 1929, which reported studies conducted by the U. S. D. A. Forest Products Laboratory.

The results showed that present specifications for the preservative treatment of wood do not give sufficient attention to the variability in results that may occur when timbers of different lengths and different cross-section dimensions are treated in accordance with the specifications. Absorption by volume of timber is the most satisfactory and convenient method of specifying treatment provided it is based on a consideration of the ratio of surface area to volume. The ratio of surface area to volume does not need consideration when the timbers are largely sapwood or when an open, porous condition of the wood makes it possible to obtain practically complete penetration.

Data on proportional absorptions are tabulated to assist in determining the approximately correct absorption for different classes of material.

Book Review

"Trials of the Combine-Harvester Thresher in Wiltshire, 1928," by J. E. Newman and J. H. Blackaby is a paper bound booklet of 50 pages reporting trials conducted by the Institute for Research in Agricultural Engineering, University of Oxford. The trials were conducted in August and September 1928. Conclusions drawn are that "The combine is a practical means of harvesting grain in this country. The climate is not a bar to its use, and its adaption should be seriously considered by large grain growers. Where straw is required for sale, and is an important part of the crop, the use of the combine cannot be recommended.

"Means of drying the grain must be regarded as a necessary part of the combine harvesting plant."

Copies may be obtained from the Oxford University Press, 114 Fifth Ave., New York, N. Y. at 70 cents.

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RAYMOND OLNEY, Editor

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By-Products in Congress

OPPORTUNITIES for the utilization of agricultural by-products and wastes have been dramatized with the result that four bills designed to promote research along this line have been introduced in the present session of Congress. They are the Dickinson Bill (H.R. 194), the Fulmer Bill (H.R. 197), the Cross Bill (H.R. 2015), and the Cross Bill (H.R. 2389). Obviously all these bills will not pass, and possibly none of them will. However, the fact that they have been presented suggests an analysis of the considerations involved.

The Dickinson and Fulmer Bills, which differ in only one point, provide particularly for research on the utilization of agricultural products other than forest products. The Cross Bills, of which the second is apparently an enabling bill for the first, specify research in connection with the industrial utilization of waste products from the land. None of the authors apparently see the need of intense and continuous research in connection with the utilization by any means of all of the major products of biologic production. However, the Dickinson and Fulmer Bills come considerably nearer to it than those of Mr. Cross, and contain elastic provisions which his do not.

Representatives Dickinson and Fulmer would have the research include experiments, investigations and tests on the physical and chemical properities of agricultural products affecting their collection, preservation and utilization; a truly scientific method of approach. Mr. Cross would limit the research to a determination of the products of marketable value which might be made from the present waste products from the land. His study apparently would neglect the agricultural engineering problem of the collection of such wastes, the possibilities of finding new uses for products which are at present not waste, and economic questions as to the merits and profit possibilities of various methods and processes. In fact, the Cross Bills provide only for work on the chemical engineering angle of the problem, and that in a manner not entirely satisfactory.

Each of the authors has his own idea as to where the research should be conducted. Mr. Dickinson wants it in Iowa in cooperation with Iowa State College. Mr. Fulmer, who has changed the wording of the Dickinson Bill only in this respect, suggests South Carolina and its state agricultural college at Clemson. Mr. Cross, while submitting the smaller bill, covering only one phase of the problem, offers the assistance of the largest state in the Union for carrying out the work.

A practice which has proven itself in European countries and which seems to be gaining favor in this country is pertinent to the question. It is the practice of centralizing, as far as possible, research along specific lines. This centralization involves principles of unity and coordination which add strength and efficiency to a research program. From this standpoint, Iowa State College, where the department of chemical engineering, the department of agricultural engineering and the U. S. Bureau of Standards are already cooperating on a research program of this kind, would be a favored location, Washington, D. C., with its U.S.D.A. and Bureau of Standards research facilities, would be another. Crop areas and the extent to which the suggested states would be willing to cooperate would also be important considerations.

Representative Cross apparently feels that the part of the problem covered by his bill could soon be solved as a project of the Bureau of Standards with a little Texas hospitality and cooperation. His enabling bill would make $150,000 available until June 30, 1931, provide for building and operating semi-commercial factories with that amount, and imply cooperation only with institutions and manufacturers of Texas. That would leave out the U.S.D.A which has already done a great deal of work on the problem and which should be included in any further research by the federal government toward its solution.

The other two representatives would have their bills administered by the Department of Agriculture. They specify close cooperation with the Department of Commerce and the agricultural research agencies of the state involved. Rather than temporary semi-commercial factories, they would establish an experiment station to become a unit in the great agricultural experiment station system of the various states and the Department of Agriculture. They provide for its operating continuously rather than as a short-time project, recognizing that new problems of utilization will arise continually as long as there is agricultural and industrial progress.

The passage of any one of the bills would undoubtedly represent a step forward, but while we are hoping we hope for the best.

Expanding Markets

THAT the Federal Farm Board will study methods of expanding markets and developing by-products is an encouraging sign. In the possibility of expanding markets lies the possibility of making agriculture a growing, dynamic industry, capable of absorbing rather than casting off manpower.

Opportunities for enlarging agricultural markets are three. In the first place, agriculture has improved and made use of only a small part of the biologic resources available to it. It might profitably divert more of its efforts from the production of staples to the production of new specialities with plants or animals which are not now considered important to agriculture.

In the second place, the products of biologic production have not been used to the fullest extent economical in satisfying the market demands of the present day. Not only by-product utilization, but new uses for staple commodities as well, might be developed.

In the third place, the undiscovered depths of the consumer's mind contain unknown wants which only need to be discovered, supplied and advertised in order to build up a new market. This opportunity is as open to agriculture as to any other industry.

To prove and reduce to agricultural practice these suggestions for expanding markets will require research—in economics, plant industry, agricultural chemistry, home economics (the consumer's viewpoint), agricultural engineering and other subjects.

Who's Who in Agricultural Engineering

C. E. Ramser

P. S. Rose

L. C. Prickett

E. R. Gross

C. E. Ramser

Charles Ernest Ramser (Mem. A.S.A.E.) is senior drainage engineer with the division of agricultural engineering, U. S. D. A., and is in active charge of the farm operations and engineering phases of the soil erosion investigations on several federal soil erosion farms that have been established in the Middle West. He received his bachelor's degree in civil engineering from the University of Illinois in 1909. After graduation he was for two years instructor in highway and hydraulic engineering at the Polytechnic Institute in Brooklyn, New York. While there he was employed during the summer as assistant designing engineer on the New York Board of Water Supply working on the Catskill Aqueduct. Later he was engaged about one year as hydrographer with the Knoxville Power Company at Alcoa, Tennessee. In 1913 he took a position with the U. S. Department of Agriculture and has been engaged in terracing, soil erosion, run-off, drainage and flood control work since that time. He is the author of a number of bulletins, reports and technical articles especially relating to research work on the above mentioned subjects. He has been chairman of the Committee on Run-off from Agricultural Lands for the past three years and has served as member on the drainage and soil erosion committees.

P. S. Rose

Philip Sheridan Rose (Charter A.S.A.E.)—third president (1910) of A.S.A.E.—is editor of "The Country Gentleman." He is an engineering graduate of Michigan State College, class of 1899. For a few months following graduation he was in the employ of the Bickford Drill and Tool Company of Cincinnati, but the same year received an appointment on the engineering faculty of the North Dakota Agricultural College. He had charge of all shops and farm courses in power machinery at that institution, resigning in 1909 to become associated with the Clarke Publishing Company in an editorial capacity. He joined the editorial staff of "The Country Gentleman" in 1917 and nearly two years ago was advanced to the position of editor-in-chief. In addition to the office of president, Mr. Rose has served A.S.A.E. in several important capacities, at present being a member of the Publications Committee. He is generally recognized as one of the outstanding leaders in the agricultural engineering field, in connection with the development of which he has exerted widespread influence.

L. C. Prickett

Lee Clement Prickett (Assoc. Mem. A.S.A.E.) is assistant director of the National Committee on the Relation of Electricity to Agriculture. He had early leanings toward electrical engineering but was prevailed upon to take a course in general agriculture at Ohio State University and received his bachelor's degree in 1920. After trying dairy farming in Alabama for three years and spending one year at various other jobs, he still wanted to get into electrical engineering work. Going to the General Electric Company at Schenectady in 1924, he succeeded in getting into Steinmetz's laboratory. After about a year and a half of hard work in the laboratory and on testing, and of studying in spare time, he was made agricultural engineer. When the Committee on the Relation of Electricity to Agriculture needed an assistant director he had the personal qualifications, agricultural and electrical engineering training, and practical farm experience which the job called for. He has held that position since March, 1927, and in that capacity served as director of the National Rural Electric Project from the time it was organized until a permanent director could be secured.

E. R. Gross

Edward Robert Gross (Mem. A.S.A.E.) is professor and head of the department of agricultural engineering at Rutgers University, chief in agricultural engineering in the New Jersey Agricultural Experiment Station, and extension specialist in agricultural engineering. He received his bachelor's degree in agriculture, major in agricultural engineering, at the University of Nebraska in 1913, and at the same time, a bachelor's degree in education at the Nebraska State Normal College. After graduation he studied engineering in Colorado Agricultural College. Since becoming a member in 1917, he was chairman of the farm power committee in 1918, chairman of the Southern Section in 1919, chairman of the Committee on Fertilizer Placement since 1925 and vice-chairman of the North Atlantic Section in 1929. He has been engaged in agricultural engineering teaching as follows: 1911-13 University of Nebraska; 1913-14, the Nebraska School of Agriculture; 1914-18, Colorado Agricultural College; 1918-19, extension specialist; 1919-22, professor and head of department, Mississippi A. & M. College; and since 1922 in his present position.

A. S. A. E. and Related Activities

PROGRAM

Meeting of North Atlantic Section
American Society of Agricultural Engineers
Memorial Building, Massachusetts Agricultural College
Amherst, Mass.
October 17, 18 and 19, 1929

Forenoon Session — Thursday, October 17

1. Registration at Memorial Building (10:00 a.m.)
2. Address of the Chairman of the North Atlantic Section —W. C. Harrington, field agricultural engineer, Portland Cement Association
3. "What Electric Utilities Can Do for Agriculture" — H. C. Fuller, agricultural engineer, Utica Gas and Electric Co.
4. "Farm Mechanics in High School Agricultural Courses" — R. W. Stimson
5. "Farmstead Electric Wiring" — J. W. Savage, General Electric Co.

Afternoon Session — Thursday, October 18

6. Address of Welcome — Dr. R. W. Thatcher, president, Massachusetts Agricultural College
7. "What Experiment Stations Are Doing to Further Engineering in Agriculture" — F. G. Sievers
8. "Research in Farm Structures" — Henry Giese, senior agricultural engineer, U. S. Department of Agriculture
9. "Electric Ventilation of Dairy Buildings" — Mr. Minot, Hunt-Helm-Ferris

Evening Session — Thursday, October 18

10. Farm Machinery Symposium — Led by G. M. Foulkrod
    (a) "Tractor-Combine" — F. L. Fairbanks
    (b) "Central Spray Plants" — E. R. Gross
11. Farm Structures Symposium — Led by F. D. Cornell
    (a) "Commercial Value of Sanitation" — L. G. Heimpel
    (b) "Economics of Dairy Stable Equipment" — W. F. Crane
    (c) "Farm Fruit and Vegetable Storage" — C. I. Gunness
12. Farm Electrification Symposium — Led by W. T. Ackerman
    (a) "Electric Brooders" — A. J. Van Scholck
    (b) "Electric Hot Beds" — R. H. Denman
    (c) "Electric Hay Hoists" — E. W. Pilgrim
    (d) "Roe Electric Plow" — L. S. Caple
    (e) "Rural Lines Construction" — F. laT. Budgett
    (f) "Rural Electric Extension" — J. R. Haswell

Forenoon Session — Friday, October 18

13. "The Small Farm Electric Plant" — J. E. Waggoner, manager, public relations division, Delco-Light Company
14. "The Retail Dealer and the Agricultural Engineer" — Grant Wright, editor, "Eastern Dealer"
15. "Experimental Work of Use to Agricultural Engineers"— F. P. Cartwright, chief engineer, National Lumber Manufacturers Association
16. "Economics of Farm Structures and Equipment" — Van B. Hart

Afternoon Session — Friday, October 18

17. "Producing Color and Texture on Concrete Surfaces"— W. G. Kaiser, agricultural engineer, Portland Cement Association
18. "Trends in Rural Electrification" — W. C. Krueger, extension specialist in rural electrification, New Jersey State College
19. "Lubricants and Fuels for Tractors and Trucks" — H. T. Kennedy
20. "Research in Agricultural Engineering"— R. W. Trullinger, agricultural engineer, Office of Experiment Stations, U. S. Department of Agriculture
21. Business Session

Evening — Friday, October 18

22. Banquet (Lord Jeffery Hotel, 6:30 p.m.)

Forenoon Session — Saturday, October 19

23. Construction of Milk Houses and Insulated Milk Tanks" — F. W. Small, field agricultural engineer, Portland Cement Association
24. "Electric Refrigeration" — W. L. Cummings
25. "The Cooling of Milk" — H. W. Riley, chief, rural engineering department, Cornell University. Discussion by W. S. Ireland and R. P. Harrington

TENTATIVE PROGRAM

Meeting of Rural Electric Division
American Society of Agricultural Engineers
Hotel Sherman, Chicago, December 4 and 5, 1929

Morning Session — Wednesday, December 4

1. "Value of High Grade Milk" — (By a large retail distributor)
2. "Production of High Grade Milk" — (By a large and a small dairyman)
3. "Recent Developments in Equipment for the Small Dairy" — (By manufacturers' representatives)
4. "Experiences of Rural Electric Servicemen With Dairy Equipment" — (By rural service engineers)

Afternoon Session — Wednesday, December, 4

5. "Refrigeration and Handling of Poultry Products" — (Speaker to be selected)
6. "Developments in Electric Incubation and Brooding" — (Reports of recent research and investigations)
7. "New Developments on the Rural Electrification Projects" — (By project leaders)

Morning Session — Thursday, December 5

8. "Livestock Feeds — Value of Processing" — By animal, dairy and poultry husbandry specialists)
9. "Economic Limit of Small Grinding Plants" — (Speaker to be selected)
10. "Grinding for the Large Beef Cattle Feeder" — (Speaker to be selected)

TENTATIVE PROGRAM

Meeting of Power and Machinery Division
American Society of Agricultural Engineers
Hotel Sherman, Chicago, December 2 and 3, 1929

Forenoon Session — Monday, December 2

1. "Experiences in Industrialized Wheat Production" — John S. Bird, president, The Wheat Farming Co.
2. "Trends in Large-Scale Wheat Production" — Hickman Price, Texas wheat grower
3. "The Banker's Viewpoint on Organizing Large Farming Units" — (Speaker to be selected)
4. "Fundamental Factors Which Determine the Effective Capacity of Large Field Machines" — E. G. McKibben, associate professor of agricultural engineering, Iowa State College

Afternoon Session — Monday, December 2

5. General-Purpose Farm Tractor Symposium
    (a) "Corn Planting With General-Purpose Tractors"— J. Leo Ahart, Iowa farmer (tentative)
    (b) "Cultivating Equipment for the General-Purpose Tractor" — Theo. Brown, manager, experimental department, Deere & Co.
    (c) "Spraying Equipment for the General-Purpose Trator" — Wm. Abildgaard, John Bean Mfg. Co.
    (d) "Dusting Equipment for the General-Purpose Tractor" — J. A. Chater, Niagara Sprayer and Chemical Co.
    (e) "Organization of Research in the Adaptation of the General-Purpose Tractor" — R. W. Trullinger, agricultural engineer, Office of Experiment Stations, U. S. Department of Agriculture
    (f) "New Developments in Wheel Design for the General-Purpose Tractor" — R. J. Altgelt, Oliver Farm Equipment Co.
    (g) "Adapting the Weeder to the General-Purpose Tractor" — A. W. Reynolds, Babcock Mfg. Co.
    (h) "The General-Purpose Tractor in Potato Production" — H. B. Josephson, research engineer, Pennsylvania State College
    (i) "Designing Hay Machinery for the General-Purpose Tractor" — R. H. Driftmier, Kansas State Agricultural College

General Discussion

Evening Session — Monday, December 2

6. Committee Reports
    (a) Committee on Dairy Engineering — A. W. Farrall, chairman
    (b) Committee on Grain Drying — W. M. Hurst, chairman
    (c) Committee on Weed Control — A. J. Schwantes, chairman
    (d) Committee on Fertilizer Placement — E. R. Gross, chairman

(e) Committee on Hay and Forage Crop Drying — H. B. Josephson, chairman
(f) Committee on Combine Development — E. H. Mervine, chairman
(g) Committee on Row Crop Management — G. W. McCuen, chairman

Forenoon Session — Tuesday, December 3

7. "The New Process of Wrought Iron Manufacture in Relation to Farm Equipment Requirements" — Dr. James Aston, consulting metallurgist, A. M. Byers Company
8. "Future Requirements of Potato Machinery" — Dr. E. L. Nixon, Pennsylvania State College
9. "Need for Further Standardization of the Power Take-Off" — W. L. Zink, engineer, General Implement Company

Afternoon Session — Tuesday, December 3

10. "Use of Crucible Steel in the Farm Equipment Industry" — F. F. McIntosh, Crucible Steel Company of America
11. "The Farm Transportation Problem" — C. M. Eason, supervisor, equipment and sales engineering, General Motors Truck Co.
12. "Relation of Farm Machinery to Maintenance of Soil Fertility" — C. A. Bacon, research engineer, Oliver Farm Equipment Co.
13. "Weed Control in the Spring Wheat Area" — J. G. Haney, International Harvester Co.

TENTATIVE PROGRAM

Meeting of Structures Division
American Society of Agricultural Engineers
Hotel Sherman, Chicago, December 3 and 4, 1929

Forenoon Session — Tuesday, December 3

1. "National Problems in Farm Home Making" — Mrs. Chas. M. Sewall, director, home and community work, American Farm Bureau Federation
2. "The Home Modernizing Bureau and the Farm Home"— H. S. Sackett, director, Home Modernizing Bureau
3. "The College Policy in Farm Home Development" — Deane G. Carter, professor of agricultural engineering, University of Arkansas

Afternoon Session — Tuesday, December 3

4. "More Farm Storage for Wheat" — H. M. Bainer, director, Southwest Wheat Improvement Association
5. "The Need of Farm Grain Storage" — Hon. S. R. McKelvie, member, Federal Farm Board (tentative)
6. "Recent Investigations in Grain Storage" — F. C. Fenton, chief, agricultural engineering department, Kansas State Agricultural College

Forenoon Session — Wednesday, December 4

7. "Report on Dairy Barn Questionnaire Project" — W. G. Ward, agricultural engineer, Iowa State College
8. "Standard Milk Control Code" — Leslie C. Frank, office of milk investigations, U. S. Public Health Service (tentative)
9. "Floor Heating as a Factor in Animal Housing" — B. M. Stahl, agricultural engineer, Ohio State University

Afternoon Session — Wednesday, December 4

10. "The Farm Building Research Situation" — Henry Giese, senior agricultural engineer, U. S. Department of Agriculture

General discussion by individuals and representatives of organizations interested in the development of modern farm buildings

11. Business Session

American Engineering Council

NEWS of interest to agricultural engineers, reported by American Engineering Council during the past month includes the publication by the U. S. Government Printing Office, of H. R. Doc. 573, 2nd S., 70th Congress, a 740 page book entitled "Relation of Forestry to the Control of Floods in the Mississippi Valley."

In his letter of transmittal to the President, former Secretary of Agriculture, W. M. Jardine, stated: "The results even when based on acknowledged incomplete and conservative data, are of such significance that it does not seem possible that the part the forests play in the control of floods can be longer ignored. Certainly it would seem that any plan of river control that does not include forestry as an auxiliary measure would overlook an important aid in the control of floods at their source."

E. A. Sherman, Associate Forester of the Forest Service, in the chapter entitled "Protection Forests of the Mississippi River Watershed and Their Part in Flood Prevention" states:

"In the course of this study it was found that reliable data essential to accurate determination were in many instances nonexistent. Topographic maps, soil maps, forest maps were too often lacking for important regions.

"It seems fundamental to a carefully planned study of land use, covering long-time periods, that there be available accurate data for each of the major tributaries of the river showing annual and periodic run-off and total and periodic volumes of silt content. Dependable data on silt content were woefully lacking. Determinations made many years ago could not be checked against similar data of more recent date because recent measurements had not been made. A complete record of stream-flow measurements and silt determinations at some point below Cairo and on each of the principal tributaries entering the Mississippi River below that point and covering the past four decades would have been of inestimable value in this study. Such records beginning in 1928 would become increasingly valuable from year to year. Regardless of any light the data might throw on the flood problem, it would give a splendid check on the problem of land use and the trend of soil erosion. By means of such records it would be possible at any time to determine whether or not efforts in reforestation, forest protection, contour plowing, and farm terracing were reducing the burden of silt in the river at Cairo or in any of the tributaries under observation. For that reason, the absence of such data is noted in this report, and the desirability of securing accurate information of this kind is given a place in the conclusions and recommendations."

This investigation substantiates what has been repeatedly stated in reports rendered by the Flood Control Committee of American Engineering Council, namely, that sufficient study has not been made and sufficient data was not available to warrant the Government in adopting the present plan for flood control of the Mississippi.

What are described as "some startling facts" are brought to light in the report. It is shown that the forests of the Mississippi watershed, even in their present largely mismanaged condition, were responsible for a reduction in the possible flood crest of nearly 15 inches. Were all the forests of the Mississippi drainage area protected and managed in accordance with established forestry principles, it is declared, a further reduction in possible flood crests of 55 inches would be possible. This restraining effect would be equivalent to the storage capacity of some 4.6 reservoirs, each with a capacity of 10,000,000 acre-feet.

Council itself has in process of publication a roster of engineers who have served as members of its assembly since its organization, and a new edition of its Constitutions and By-Laws.

The fall meeting of the Administrative Board will be held at the Mayflower Hotel, Washington, D. C. on Thursday afternoon, October 24, and Friday, October 25. An executive committee meeting will be held on the morning of October 24 in the office of the Executive Secretary.

Board of Surveys and Maps Receives Report on Map Collections

AT A meeting held in the Interior Building, Washington, D. C., September 10, the Board of Surveys and Maps received a preliminary report from one of its committees setting forth the agencies, the scope and purposes of the various map collections in the District of Columbia.

The report gave the name of the agency, its address,

person in charge, approximate number of maps in collection, kind, type and use for which maps are suitable.

Agencies in the District of Columbia possessing map collections are as follows:

Government Departments

Board of Surveys and Maps

State: Geographic Section

War: General Staff, M.I.D., Geographic Branch
Q. M. Corps, Construction Service
Chief of Engineers: Map Files
Intelligence Section
Reproduction Plant
Mississippi River Commission
Lake Survey
Air Corps
Bureau of Insular Affairs

Post Office:
Topography Division

Navy: Hydrographic Office
Yards and Docks

Interior:
General Land Office
Indian Service
Geological Survey
Reclamation Bureau
Park Service

Agriculture:
Weather Bureau
Forest Service
Bureau of Chemistry & Soils, Soil Surveys
Biological Survey
Bureau of Public Roads
Division of Agricultural Engineering

Commerce:
Aeronautics Branch
Bureau of Census, Geographic Section
Foreign & Domestic Commerce, Geographic Sec.
Coast and Geodetic Survey

Independent Establishments

Library of Congress
Government Printing Office, Supt. Documents
Interstate Commerce Commission, Map Section Valuation, Land Section
International Boundary Commission, Canada
Federal Power Commission
Public Buildings and Public Parks
Pan American Union
District of Columbia:—Assessor
Surveyors Office
Public Library

Non-Governmental

National Geographic Society
American Automobile Association
Carnegie Institution—Terrestrial Magnetism
Rand, McNally & Co.
Chas. G. Stott & Co.
Note: Other stationers carry commercial maps

American Standards Association

THE technical committee on standardization of twist drill sizes, a sub-group of the sectional committee on small tools and machine tool elements (B 5) has conducted an intensive study of the 138 drill sizes carried in stock by the various drill manufacturers and users in the size range from number 80 (0.0135 inch) to one-half (0.5000 inch) inclusive. As a result of this study the committee has prepared two proposals covering diameter and length, which are considered satisfactory for use by industry. The proposals are now being circulated for review among users of these drill sizes to determine which are preferred. Copies of the proposals may be borrowed through the A.S.A. office.

The 1929 edition of the National Electrical Code has been declared an Approved American Standard by the A. S. A. The Code, originally drafted in 1897, has for 30 years been the basic guide for safe practices in the wiring of consumer premises for the use of electricity for light, heat and power. The forthcoming edition is the fifteenth revision of the original text. Fairly frequent and ofttimes extensive changes in its provisions are made necessary by rapid and new developments in the extent and ways in which science and industry make it possible for the public to take advantage of electricity's "niagaruan" energies.

A sectional committee under the sponsorship of the National Fire Protection Association drafted the Code. The electrical committee contains 75 members and alternates representing 36 national and local organizations. These include federal, state and municipal officials, as well as men from 8 subdivisions of the electrical industry, from the fire insurance organizations and from general interests, such as architects and building owners.

Technical provisions of the new edition are not materially different from those of the former "approved" text. Certain new practices in wiring methods have secured recognition and a need for economies in other methods has been satisfied.

Specifications for outlet boxes have been approved by the A.S.A. as an American standard, and copies will be for sale at the A.S.A. office within a few weeks. This standard was submitted by the Underwriters' Laboratories under the proprietary sponsorship method, and is now in actual use in the Laboratories in judging the acceptability of outlet boxes submitted for examination, test and report.

Standards on Routine Analysis of White Pigments (K 15-1929) and Routine Analysis of Dry Red Lead have been approved as American Standards by the A.S.A. They were submitted by the American Society for Testing Materials under the proprietary method. Copies will be available for sale very soon, at 25 cents each.

Two more sub-divisions of the project on Scientific and Engineering Symbols and Abbreviations (Z 10) have been approved by the A.S.A. These are "Graphical Symbols for Telephone and Telegraph Use (Z 10g6-1929)" and "Symbols for Hydraulics (Z 10b-1929)."

Personals of A.S.A.E. Members

Harold T. Barr has been appointed assistant professor of agricultural engineering at the Louisiana State University, Baton Rouge, La., and will devote half time to teaching and the other half to experiment station work. He was formerly assistant professor of agricultural engineering at the University of Arkansas.

C. A. Logan has been appointed assistant professor of agricultural engineering of the Kansas State Agricultural College, Manhattan, Kansas. He was formerly connected in a similar capacity with the Colorado Agricultural College.

J. W. Pincus advises that **J. B. Davidson**, who has spent the past summer in Siberia with Dr. Franklin Harris, president of Brigham Young University, investigating the possibilities of a plan of the Soviet Government for the colonization of Russian Jews, is now on his way back to this country with the commission. The party is due in New York about October 22. On October 25 it is to give a report of its findings at a dinner at the Lincoln Hotel in New York City. Friends of Dr. Harris and Prof. Davidson who would like to meet them and hear their report at that time should get in touch with Mr. Pincus at 25 E. 26th St., New York, N. Y.

L. O. Russell, until recently employed as salesman by J. I. Case Company, Inc., Wichita, Kansas, is now assistant in the collection department of their Kansas City (Missouri) office. Mr. Russell's mail address is 5807 Wayne Street.

L. H. Schoenleber has been appointed land clearing specialist of the division of agricultural engineering, University of Minnesota, Universty Farm, St. Paul. He is a graduate in agricultural engineering of the University of Nebraska and recently received his master's degree from Iowa State College.

John W. Sjogren, in charge of farm mechanics, Colorado Agricultural College, is joint author with F. L. Cooper of Bulletin No. 247-A, entitled 'Septic Tanks for Farm Sewage Disposal," recently issued by the Colorado Agricultural College.

J. Macgregor Smith, professor of agricultural engineering at the University of Alberta (Canada), is author of extension bulletin No. 10 of the University, entitled "Binder and Knotter Troubles." The hird edition, revised, of this bulletin was published in July.

C. P. Sun has been appointed, for the coming year, an associate professor at the National Central University at Nanking, China, to take charge of reclamation courses and organize a four-year course in agricultural engineering. For the past year he has been agricultural engineer and vice-director of Kiangsu Farm Implements Manufactory at Soochow, which is just getting into production on crude oil engines, pumps and other smaller agricultural implements such as plows, planters, and cultivators. He reports that the market for such equipment is very encouraging as during the past irrigation seasons there has been a large demand for this sort of equipment.

Applicants for Membership

The following is a list of applicants for membership in the American Society of Agricultural Engineers received since the publication of the September issue of AGRICULTURAL ENGINEERING. Members of the Society are urged to send information relative to applicants for consideration of the Council prior to election.

Carl V. Englund, farm fieldman, Portland Cement Association, Denvero, Colo.

Kirk Fox, editor, Meredith Publishing Co., Des Moines, Ia.

Lester W. Garver, assistant in sales department, Massey-Harris Co., Columbus, Ohio.

Robert R. Graham, professor of agricultural engineering, Ontario Agricultural College, Guelph, Ontario, Can.

Robert T. Harrison, county agricultural agent, Harlan, Ky.

Charles J. Hutchinson, farm engineering specialist, Louisiana State University, Baton Rouge, La.

Nicholas V. Kapercev, manager, United Slavish Agricultural Bureau, Chicago, Ill.

John S. Mack, president, G. C. Murphy Co., McKeesport, Pa.

Charles A. Marsh, ventilation engineer, Louden Machinery Co., Fairfield, Ia.

Earl R. Ohmes, farm advisor, The American Rolling Mill Co., Middletown, Ohio.

John A. Slipher, assistant professor of soils, Ohio State University, Columbus, Ohio.

Dwight D. Smith, research instructor, University of Missouri, Columbia, Mo.

Miguel Y. Solorzano, technical sub-director of reclamation service, Mexican Government, Agriculture & Credit Bank, Mexico City, Mex.

Leon F. Swartz, rural service engineer, Illinois Power and Light Corp., Bloomington, Ill.

Frank M. Wigsten, rural service director, Central Hudson Gas & Electric Corp., Poughkeepsie, N. Y.

Joseph P. Windham, farm manager, Florida Power & Light Co., Miami, Fla.

Transfer of Grade

J. H. Fulmer, farmer, Green Acre Farms, Nazareth, Pa. (Associate to Full Member.)

John Scholten, instructor, University of Idaho, Moscow, Ida. (Student to Junior Member.)

New A.S.A.E. Members

George L. Bell, general sales manager, Caterpillar Tractor Co., San Leandro, Calif.

Henry T. Burnam, agricultural engineer, El Paso Electric Co., El Paso, Tex.

Tudor J. Charles, Jr., research departments, National Association of Farm Equipment Manufacturers, Chicago, Ill.

Fred M. Chase, student apprentice, J. I. Case Co., Rockford, Ill.

S. S. Conaway, sales promotion manager, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

Ralph D. Cutler, vice-president, The Hartford Electric Light Co., Hartford, Conn.

Bruce H. Gallup, salesman, The E. A. Kaestner Co., Baltimore, Md.

Walter F. Kreiselmaier, farm manager, Fargo, N.D.

James R. McCalmont, electrician, A. M. Bayers Co., Ambridge, Pa.

Harold T. Murray, vice-president, "Electricity on the Farm," 30 N. Michigan Ave., Chicago, Ill.

Clarence R. O'Brion, district sales manager, Caterpillar Tractor Co., Moscow, U.S.S.R.

Arthur W. Reynolds, vice-president, The Babcock Mfg. Co., Leonardsville, N.Y.

Lloyd S. Schultz, rural service engineer, Pennsylvania Power & Light Co., Allentown, Pa.

Albert K. Short, conservation and terracing agent, Federal Land Bank of Houston, Houston, Texas.

C. T. Vassilieff, professor, Leningrad Agricultural Institute, Leningrad, U.S.S.R.

Russell B. Williams, editorial director, Reincke-Ellis Co., Chicago, Ill.

Employment Bulletin

An employment service is conducted by the American Society of Agricultural Engineers for the special benefit of its members. Only Society members in good standing are privileged to insert notices in the "Men Available" section of this bulletin, and to apply for positions advertised in the **"Positions Open" section.** Non-members as well as members, seeking men to fill positions, for which members of the Society would be logical candidates, are privileged to insert notices in the "Positions Open" section and to be referred to persons listed in the "Men Available' section. Notices in both the "Men Available" and "Positions Open" sections will be inserted for one month only and will thereafter be discontinued, unless additional insertions are requested. Copy for notices must be received at the headquarters of the Society not later than the 20th of the month preceding date of issue. The form of notice should be such that the initial words indicate the classification. There is no charge for this service.

Positions Open

FARM MANAGER to handle 3500-acre power farming project in Kansas on which wheat and roughage crops are grown. Man must be a mechanic to supervise operation and maintenance of tractors and other farm equipment. He should also be informed on best farming methods employed in western Kansas and should have sufficient clerical knowledge to keep data on operations performed. Should be of good character and capable of managing labor. Straight salary or salary and profit basis. PO-162.

AGRICULTURAL ENGINEER, with masters degree in agricultural engineering, wanted by a university in the Mississippi Valley, as assistant professor to handle research and some teaching in farm equipment. Salary depends on training and experience. PO-163.